AUGUST · 1957
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ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

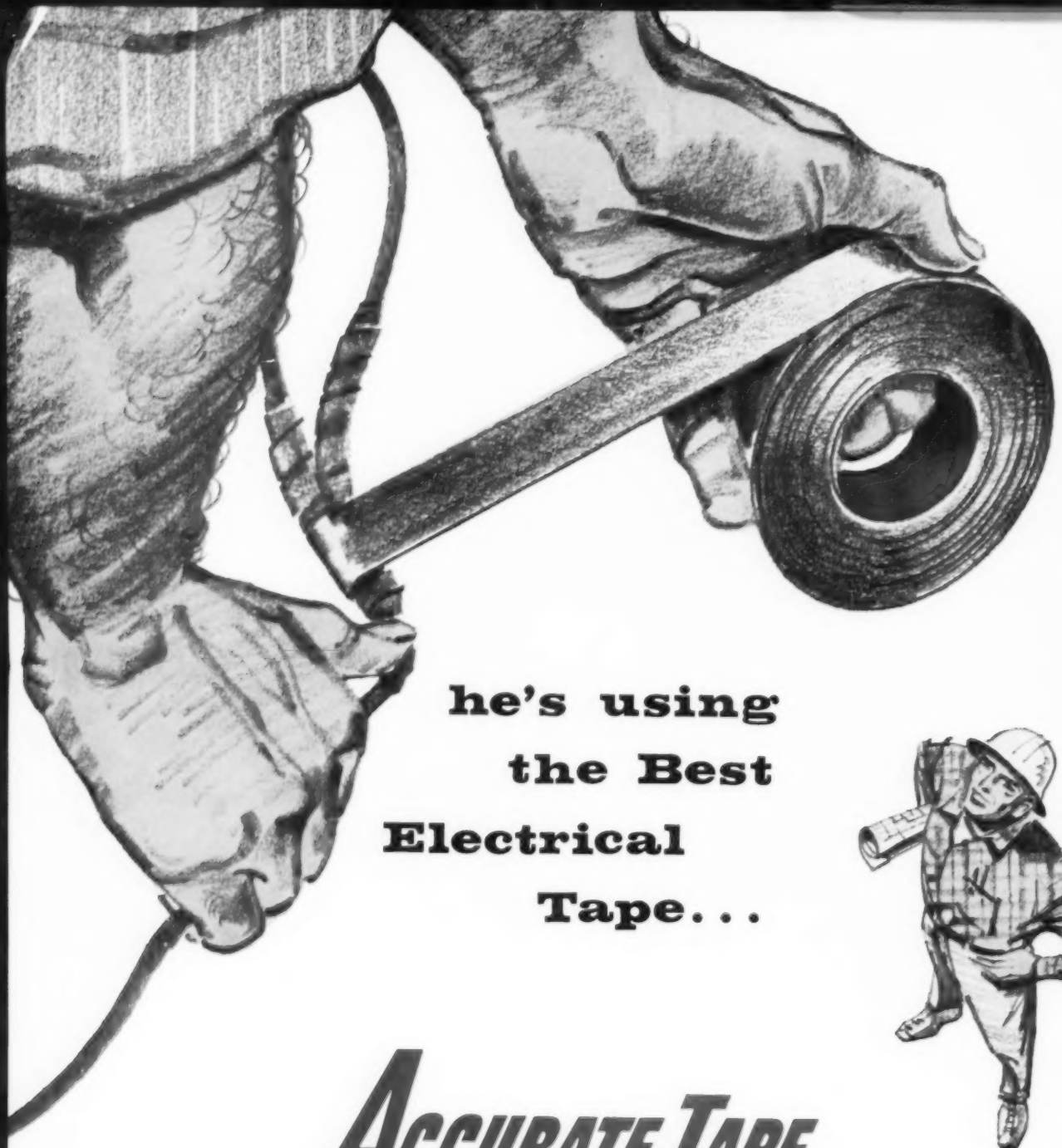
REMOTE SWITCHING of the branch and feeder circuits for plant distribution. page 67

CABLE TROUGHS serve paper mill electrical expansion program. page 74

page 78 **Housepower** — how to use the rating sheet and estimate-proposal form.

page 86 **Service Disconnects** — the case for multiple service switches and overcurrent protection.

A McGRAW-HILL PUBLICATION 56TH YEAR



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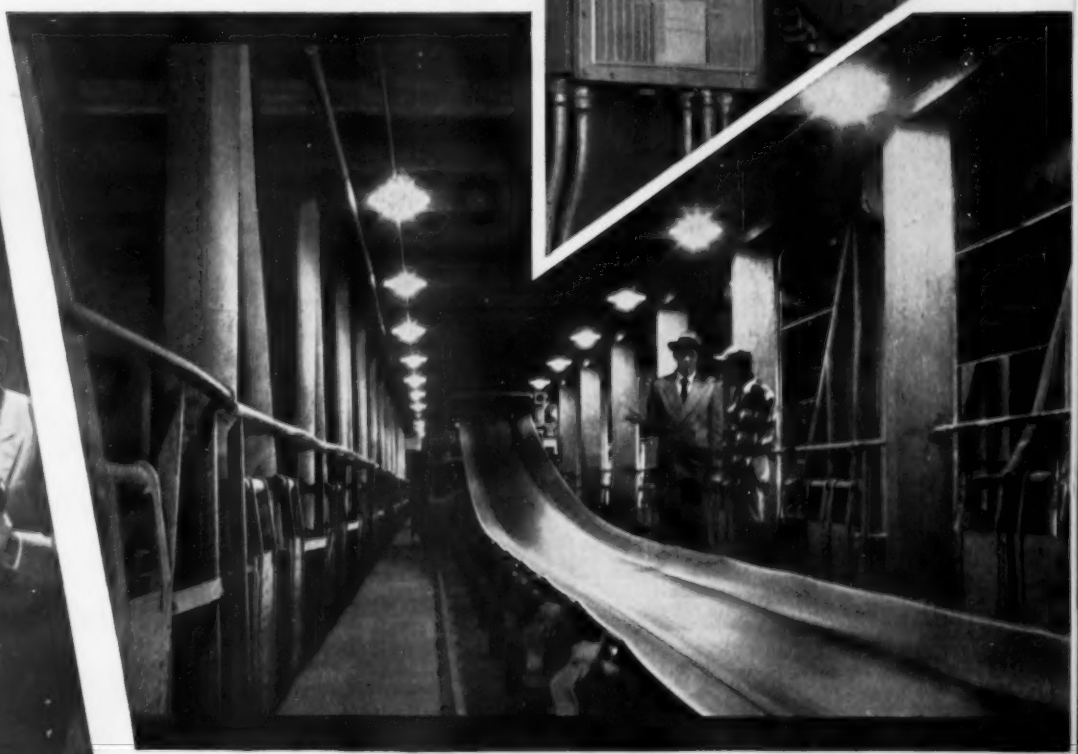

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★ Crouse-Hinds field engineers, located in offices right near the job, were ready to help 'round the clock with special problems.

★ Ordering from the Crouse-Hinds catalog was time-saving, simplified, and promised delivery dates were kept.

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Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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Sidelights

LIGHTING COMPETITION–The International Lighting Competition closes October 25. This gives eligible contestants (electrical contractors, electrical distributors, architects/engineers, and electric utilities) only a little over two more months to send in Entry Applications, get their Entry folders, fill them out and return them by the deadline.

The electric utility contestant division is out front with number of entries submitted, while the electrical contractor division has the smallest number of entries, as of late July. Contractors and engineers are urged to enter some of their good lighting jobs in this contest immediately. There are 120 cash awards available, totaling $5400.

Rules folders and Entry Application forms should be requested from Berlon C. Cooper, Chairman, 1957 International Lighting Competition, 330 West 42nd St., New York 36, N. Y.

SERVICE DISCONNECTS–Questions concerning some aspects of the Code rules applying to the use of more than one service disconnect are frequently addressed to our panel of Code authorities. B. A. McDonald has selected a number of the more common questions and discusses them against the historical background of the present rules and current industry experience with multiple disconnects and overcurrent devices in service applications. His article, "Common Code Problems", begins on page 86.

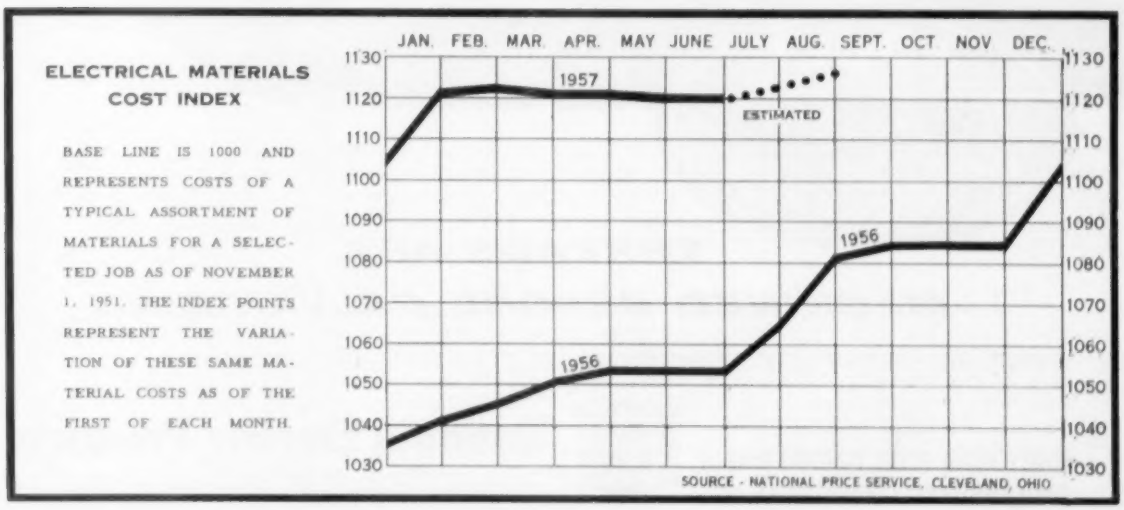
PUBLICITY PAYS–Eye-catching devices in advertising and publicity helped a Texas electrical contractor build a residential business averaging better than three rewiring projects a day. M. J. Owens of Ft. Worth uses uniformed electricians, attractive radio dispatched trucks and ties in strongly with the "Live Better Electrically" program. See "Publicity Techniques Help to Promote Residential Rewiring" page 91.

HOUSEPOWER AIDS – Practical sales aids available through the National Adequate Wiring Bureau and gaining wide use throughout the U.S. include the Housepower Rating Sheet and the Estimate-Proposal Form which are specifically designed to help the electrical contractor sell, plan and install residential wiring modernization jobs. A special report this month, "Housepower Sales Aids" page 78, prepared by the Bureau, describes these forms and gives step by step instructions on how they may be used.

CABLE TROUGHS–In expanding its electrical distrbution system, the Central Mill of the S. D. Warren Company of Muskegon, Mich., used 3000 ft of expanded metal cable trough in a 6000 kva addition to the plant electrical capacity. Details of the installation and consideration determining the methods employed are described by Osborne B. Smith, Chief Electrical Engineer, Summer Sollitt Co., in "Cable Trough Distribution" beginning on page 74.

COMING NEXT MONTH

- Annual Statistical Review. A special editorial report will summarize pertinent electrical industry statistics and trends as a guide for planning your 1958 objectives and programs.
- Guide for Distribution Changes. Robert Hastings, Manager of Engineering, Baldwin Hill Co., will describe visual control system for keeping industrial plant electrical systems ahead of load changes and expansion.
- Residential Distribution Goes Underground. Chicago's newest suburb has buried cable distribution to fiber glass transformer vaults serving 100-amp supplies.


ELECTRICAL MATERIALS COST INDEX
BASE LINE IS 1000 AND REPRESENTS COSTS OF A TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. THE INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.
JAN. FEB. MAR. APR. MAY JUNE JULY AUG. SEPT. OCT NOV DEC.
1130
1120
1110
1100
1090
1080
1070
1060
1050
1040
1030
1957
ESTIMATED
1956
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Washington Report

New construction expenditures in June were a record $4.4 billion, topping the previous June record of $4.3 billion and up 8% from May. Construction outlays reportedly amounted to $21.5 billion—3% above the previous high reported for the first half of last year. Spending for additions and alterations to private homes, public utilities and public schools, outlays for private industrial buildings, offices and warehouses, highway construction, and water and river facilities all shared in the May to June rise. Private construction, however, totalled $3 billion—a 1% drop below the year-earlier total. The slight drop stemmed mostly from a decline in new housing which has been hit by general cost increases and slowdown of new family formation as well as by the recent trend toward tighter money. Public construction reached a new June high this year at $1.3 billion—10% above May and 7% higher than a year earlier.

Chances for a school bill this year are dim. Federal aid for school construction has a slim possibility of passing in the House but favorable action in the Senate is considered unlikely this year. House approval would improve chances for next year.

Builders are pressing Washington to lower down payment requirements for insured home mortgages on new homes. Unless prompt action is taken, they say the 1958 home building starts will drop to 700,000 units. With lower down payments, the industry may build as many as 1,250,000 new homes next year.

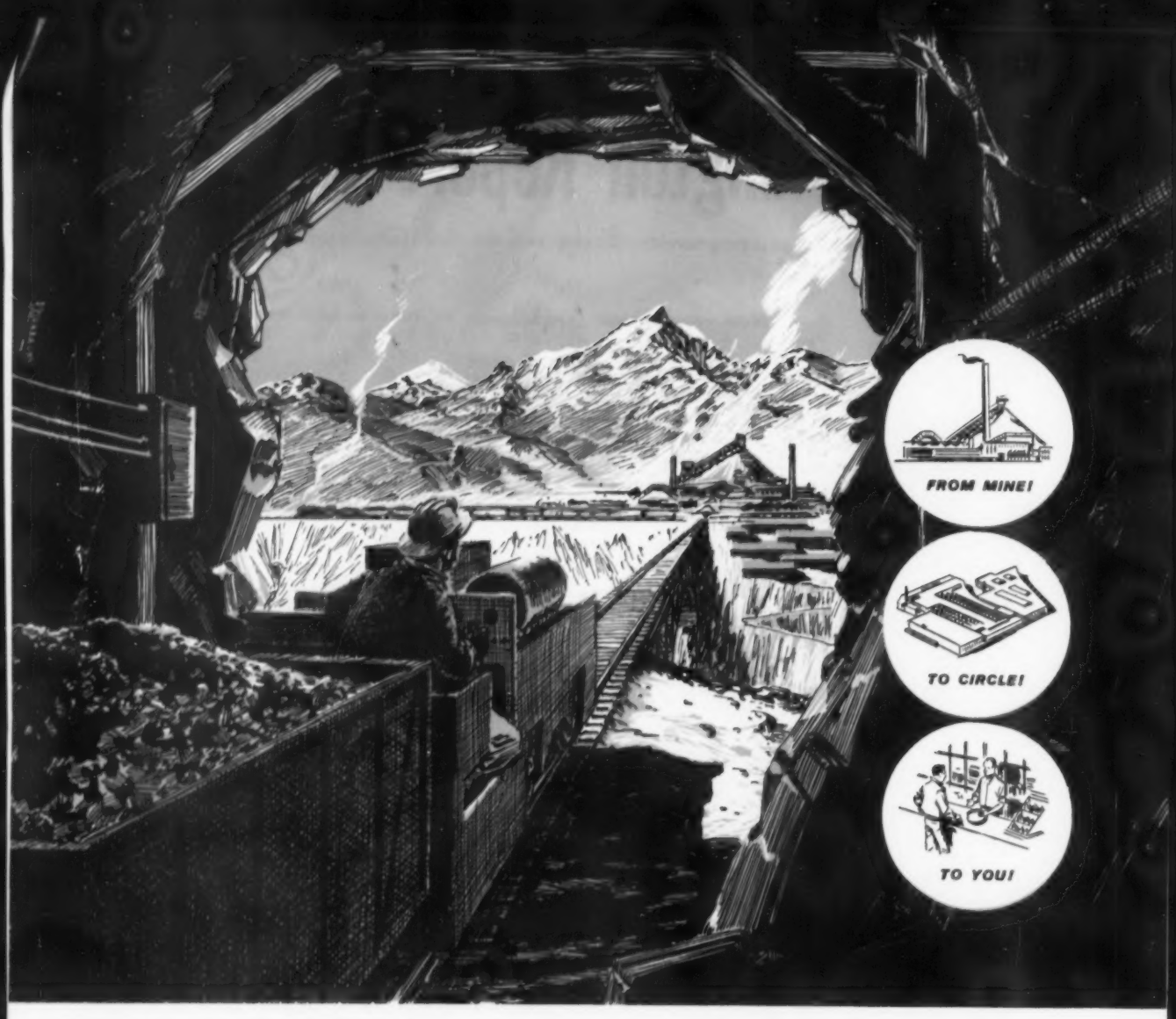
Output of electricity in mid-July showed an even 10% gain over the same period last year for the U. S. The industry generated during the week ending July 13, 11,964 million kilowatt hours as compared with 10,878 million kwh in the same period last year. Gains ranged from 2.3% in New England to 18.6% in the West Central area.

Washington continues its orthodox inflation fight. Mainstay now is the tight money policy, as all sectors of the money market are being caught by the new rise in borrowing costs. Reportedly, Washington will be slow to up credit on the next business slide; a mild turn-down in production and employment figures is considered not sufficient grounds for policy reversal.

Cost of living rose to a record high in May for the ninth straight month as statistics pegged the consumer price index for the month at 119.6% of the 1947-48 average, climbing 0.3% higher than the April figure and 3.6% above the index for May of last year.

Copper prices are easing again as summer vacations keep demand low. Copper users reported buying custom smelter copper 28¼ cents a pound, ¼ cent below the 28½-cent quoted level. Custom price now is almost half the roughly 55-55½-cent record high set in March last year. Large domestic producers kept their price unchanged at 29½ cents, but this compares with a 46-cent high that prevailed from February 17 to July 10, 1956 when producers made their first slash—a cut of 6 cents a pound to 40 cents.

Some economic highlights:—Consumers added $369 million to their installment debt figure during May as their total debt hit $41.7 billion—up $2.8 billion from the year-ago figure . . . June automobile production of 500,271 was 15.3% above that of June 1956, but below that of May . . . steel production dropped to the lowest level since August 1956 as total output for the week ending June 30th was at 84% of capacity . . . businessmen expect to spend about $9.6 billion for new plants and equipment in the third quarter of this year, down slightly from an estimated $9.9 billion of the second quarter.



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Send today for this useful wiring aid. Gives conduit sizes, amperage capacities, and motor running data. Write Dept. A8.

Is Industry Creating A New Breed of "Bonus Babies"?

THE STARTING SALARIES offered to this year's June graduates give the impression that industry is creating a new breed of "bonus babies." This is the term baseball fans apply to sturdy youngsters whose talent for hitting and throwing gets them payments of up to $100,000 and other benefits for signing a contract.

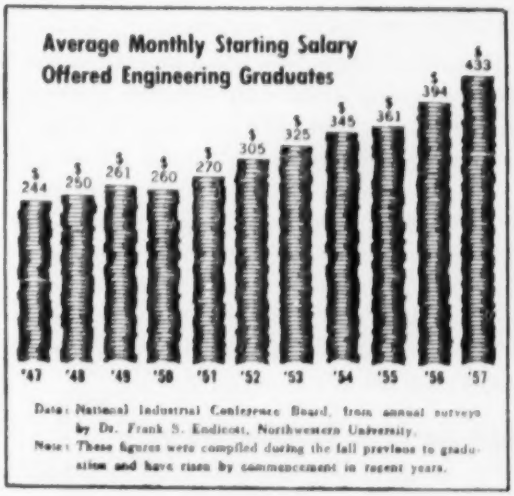
For several years industry's demand for young college graduates, especially in science and engineering, has outrun the number receiving degrees. Competition for these young people has steadily pushed up the starting salaries and has induced many companies to indulge in lavish recruiting programs. This year engineering graduates are being offered well over $400 a month, and even liberal arts graduates find numerous offers at $400 or more. Only ten years ago the salaries offered senior engineering students averaged less than $250 a month.

But any employer who assumes that high starting salaries alone will assure him the number of June graduates he wants is likely to be disappointed. A recent study by the McGraw-Hill Classified Advertising Division shows that most young engineers and scientists going into industry are more interested in their opportunities and in a company's future than they are in the size of their first paycheck.

Money Isn't Everything

In the McGraw-Hill survey, 2,596 recently-hired engineers and scientists employed in 57 companies listed the factors they had considered before accepting a position. The replies of the younger engineers and scientists—those with less than five years' experience—have great significance for employers who want to make any impression in the highly competitive market for college graduates.

- **Potential growth of the company** was listed by more young engineers and scientists than any of the 42 other items on the list as a factor that influenced greatly their decision in accepting a position.
- **Challenging opportunity** was second.
- **The company's prestige and reputation** ranked third.



Data: National Industrial Conference Board, from annual surveys by Dr. Frank S. Endicott, Northwestern University.
Note: These figures were compiled during the fall previous to graduation and have risen by commencement in recent years.

● **Progressive research and development program** was fourth.

● **Starting salary** ranked only **seventh.**

Job and Future Most Important

As a group, the factors relating to the nature of the job, its future and the company's future had by far the greatest influence in attracting young engineers and scientists to their present positions. These include three of the top four attractions—potential growth of the company, a challenging opportunity and a progressive research and development program. Other factors in this group are the company's facilities, quick advancement, self-direction or little supervision, chance to work in a certain field, small size of company and rewards for individual accomplishment.

The second most important group of attractions had to do with prestige. These include the company's prestige and reputation, executive or professional standing and association with leading men in the field. **Third in importance were financial considerations**—starting salary, regular salary increases, financing of relocation, paid vacations and holidays.

A less important group of factors influencing young scientists and engineers were essentially social. Geographic location and educational facilities in vicinity ranked fairly high. But recreational facilities, suburban or country living, pleasant housing and cultural considerations had little appeal.

Ranking lowest, by a good margin, were factors having to do with security—permanent position; health, life and surgical insurance; retirement or pension plan; and sick leave.

It is interesting to note that some of the factors which influenced the **smallest** percentage of young engineers and scientists were country club memberships, use of company car, at-cost or low-cost eating place, travel opportunities abroad and being able to buy the company's products at a discount.

A Lesson For Employers

The lesson of this survey to employers who hope to recruit more young engineers and scientists is clear. High salaries and other financial appeals are important. But, **at a time when high starting salaries are offered in abundance, our young graduates are interested even more in being with companies that will grow and in jobs that will permit them to grow. They are interested in jobs that offer opportunities for advancement, financially and professionally.**

* * *

Were the young scientists and engineers who participated in the survey trying to impress somebody with their motives? If so, it could only have been to impress themselves, for all were asked to return their questionnaires unsigned.

What Factors Influence the Job Selections of Young Engineers and Scientists?

Factors Influencing Decision Greatly	Percent Listing Factor
Potential growth of company	55%
Challenging opportunity	53
Company's prestige, reputation	44
Progressive research and development program	41
Geographic location	37
Permanent position	35
Starting salary	34
Educational facilities in vicinity	33
Regular salary increases	31
Chance to work on specific project, or in certain field	27
Company's facilities (laboratories, technical libraries, etc.)	25
Tuition for graduate study	25

Based on replies by recently-hired engineers and scientists with less than five years' experience to questionnaire distributed by McGraw-Hill Classified Advertising Division.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nation-wide developments. Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald C. McGraw
PRESIDENT

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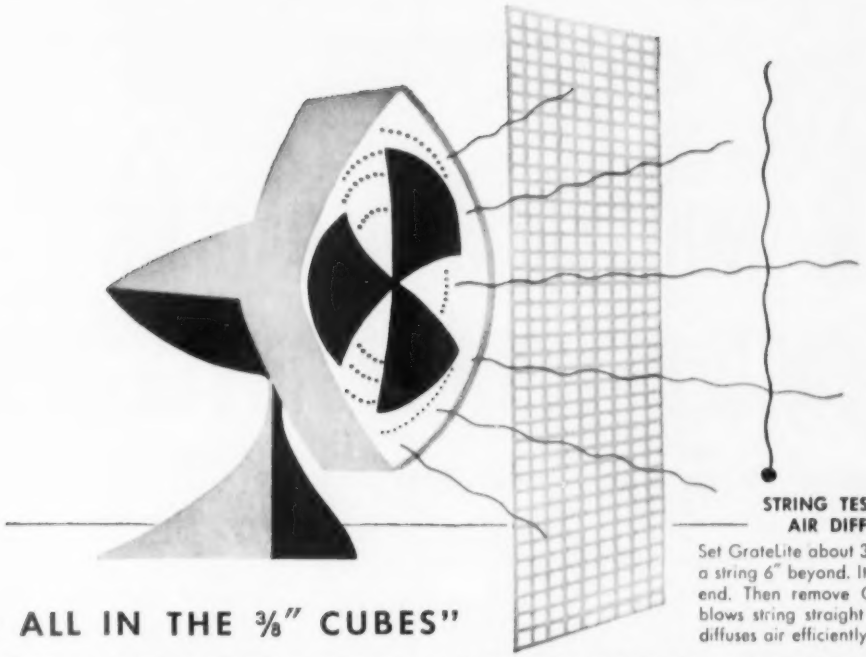

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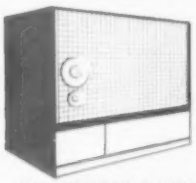
LOUVER DIFFUSER*

SUPER-COMFORT LIGHTING PLUS AMAZING AIR DIFFUSION



AIR CONDITIONERS USE ITS PRINCIPLE!

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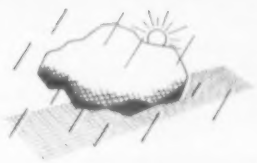


UNAFFECTED BY HUMIDITY!

GrateLite is one solid piece—not just glued-together pieces! It is dimensionally stable, and is unaffected by changes in humidity or by high humidity itself. GrateLite is a solid body!

TOUGH AND RUGGED!

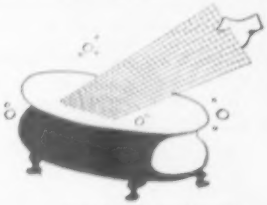
You can step on GrateLite . . . it won't mar, crumble or crunch. Its solid tapered vanes are Guth-engineered for maximum strength and ruggedness—important in maintenance!

STANDS ROUGH HANDLING!

GrateLite won't bend, buckle or mar when taken down for cleaning and relamping, etc. It won't twist in your hand. Its body and substance are designed for long use.

SCRATCH-RESISTANT!

GrateLite doesn't scar easily—or rip or break when dropped or struck by a tool. Fingernails can't mar its usefulness. No "black eyes," no damaged cubicles to destroy overall beauty and efficiency.



KEEPS ITS BEAUTY!

GrateLite holds shape when washed. Won't oxidize or blacken. Cubicles retain their shape. Scratches are unnoticeable. GrateLite isn't flat, dull or depressing. It's always cheerful, life-like and radiant.

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657

HOW L-M INDUSTRIAL CAPACITORS GIVE A HIGH RETURN ON INVESTMENT

Raise low power-factor and reduce kilovars

...increase load capacity
...improve voltage conditions
...cut power bill

By N. K. DELANEY
Product Manager
Capacitors and Regulators
Line Material Industries

Low power-factor costs you money. With low power-factor you do not use your plant facilities efficiently. You also lose part of the electricity you pay for, because of excessive losses. Today, practically every plant has manufacturing processes with loads involving induction motors producing low power-factor. These are such loads as machine tools, pumps, fans, compressors and conveyers.

The use of capacitors improves the power-factor of the load. This reduces the KVA demand, and therefore cuts power costs. It automatically increases the load capacity of the plant circuits, and provides better voltage for equipment operation and lighting. In addition to providing better operation of the plant, capacitors can substantially reduce power costs another way: where there is a power-factor clause, based on a study of the clauses of a number of utilities, capacitors can save many times their cost.

Both Large and Small Plants Benefit

Almost every size of plant having a power-factor clause in its rate structure can justify capacitors. Studies show that it is generally advantageous to improve the power-factor beyond the maximum rate of return, because even though the rate of return becomes less, it is still economically attractive, and besides, additional system power capacity is released. A rough rule is to provide improvement to 90-95 percent power-factor.

The best way to determine the capacitor kilovars to use is to calculate the actual dollar savings for various power-factor values for your particular plant condition. See examples at left.

Location of Capacitors

The maximum benefit from capacitors is obtained when they are located

Two Examples of Savings With L-M Capacitors

These two examples are typical of the savings on power bills possible through the application of low-voltage industrial capacitors.

1. Small Industrial Plant

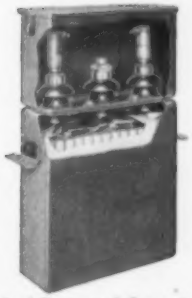
Here the rate structure included a monthly KVA demand charge, which averaged $172.28. Installation of $720 worth of capacitors cut the demand charge to $137.80, a monthly saving of $34.48. The savings will pay for the capacitors in 21 months. Here are the figures:

BEFORE Installing Capacitors		
KW	=	152
KVA	=	211
PF%	=	72
Monthly KVA demand charge	=	$172.28
AFTER Installing		
80 KVAR of 460 Volt Capacitors		
Approximate installed cost of capacitors	=	$720.00
KW	=	152
KVA	=	166
PF%	=	92
Monthly KVA demand charge	=	$137.80
Reduction in monthly KVA demand charge	=	$ 34.48
Number of months required to pay for capacitors out of savings in monthly KVA demand charge	=	21

2. Commercial Lighting User

Here the rate for a commercial user of a large amount of lighting equipment included a monthly KW demand charge with a power-factor penalty clause as follows: the monthly demand charge will increase 1% for each 1% the power-factor falls below 85%PF. Power-factor at the time was running around 76%. Installation of enough capacitors to bring the power-factor to 86% saved $24.41 per month, which is paying for the capacitors in 25 months. It figures out this way:

BEFORE Installing Capacitors		
KW	=	120
KVA	=	158
PF%	=	76
Monthly KW demand charge	=	$295.66
AFTER Installing		
30 KVAR of 230 Volt Capacitors		
Approximate installed cost of capacitors	=	$600.00
KW	=	120
KVA	=	140
PF%	=	86
Monthly KW demand charge	=	$271.25
Reduction in monthly KW demand charge	=	$ 24.41
Number of months required to pay for capacitors out of savings in monthly KW demand charge	=	25



Individual Dustproof Capacitor Unit

at the load. This is true for release of system capacity, voltage improvement, and power bill savings. On the other hand, other factors should be considered, such as load diversity, particularly when the plant contains a number of small loads. L-M engineers can help you with such problems.

Complete Engineering Service

As a large manufacturer of capacitors for utility applications, Line Material Industries offers complete engineering service on industrial capacitor installations.

Line Material development engineers will cooperate with you to determine the amount of capacity released by power-factor correction, voltage improvement, rate of return on capacitor investment, and the most advantageous capacitor location.

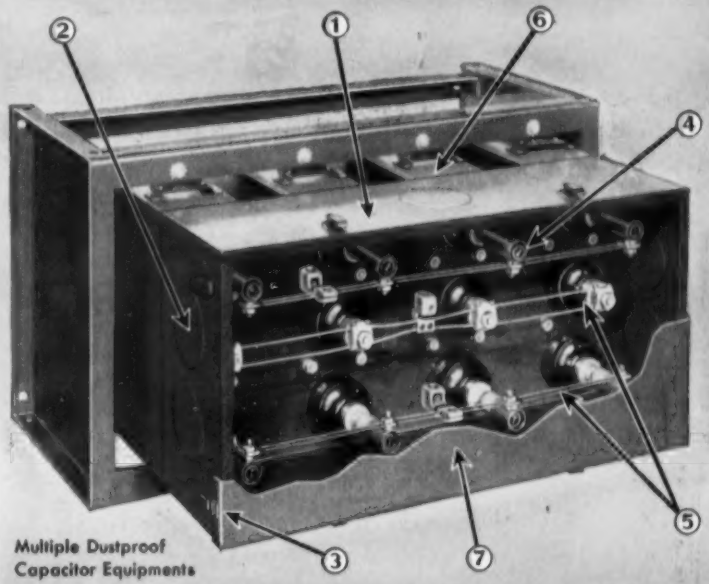
Complete Line of Industrial Capacitor Equipments

Line Material Industries offers a complete line of standard industrial capacitors, 230 to 575 volts, for installation at the motor, on the supply side of motor protective and switching devices, or at load centers.

Line Material capacitor equipments are dustproof. They can be floor, wall, or ceiling mounted. Multiple equipments are factory assembled into desired sizes, and completely wired. Installation is simple and fast. Equipments include boric acid indicating-type, terminal-mounted fuses.

Get Complete Information

Line Material capacitors may be the solution to your problem to increase load capacity, improve voltage conditions, or cut power billing. Call the nearest Line Material office for complete information and the location of the nearest distributor of Line Material equipment. Or write Line Material Industries, Milwaukee 1, Wisconsin.



Multiple Dustproof Capacitor Equipments

NEW L-M INDUSTRIAL CAPACITOR EQUIPMENTS

Have Outstanding Design Features

1. ***Enclosure***—one-piece all-steel construction.
2. ***Knockout***—3-inch on all four sides.
3. ***Cover***—one-piece, fastened by spring clips, easily removed.
4. ***Fuses***—boric acid indicating type, terminal mounted.
5. ***Internal Wiring***—factory assembled.
6. ***Unit***—strong solder-sealed bushings with low temperature Elemex liquid dielectric.
7. ***Finish***—primer followed by one coat of alkyd-resin paint.

Available in standard three-phase and single-phase ratings, 230, 460, and 575 volts.

Sold to industry through distributors. Call the nearest Line Material office for location of nearest distributor or write Line Material Industries, Milwaukee 1, Wisconsin.

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Transformers—Capacitors—Reclosers
Protective Equipment—Street Lighting
Power Switching Equipment—Regulators
Line Construction Materials—Fibre Conduit.

McGRAW EDISON

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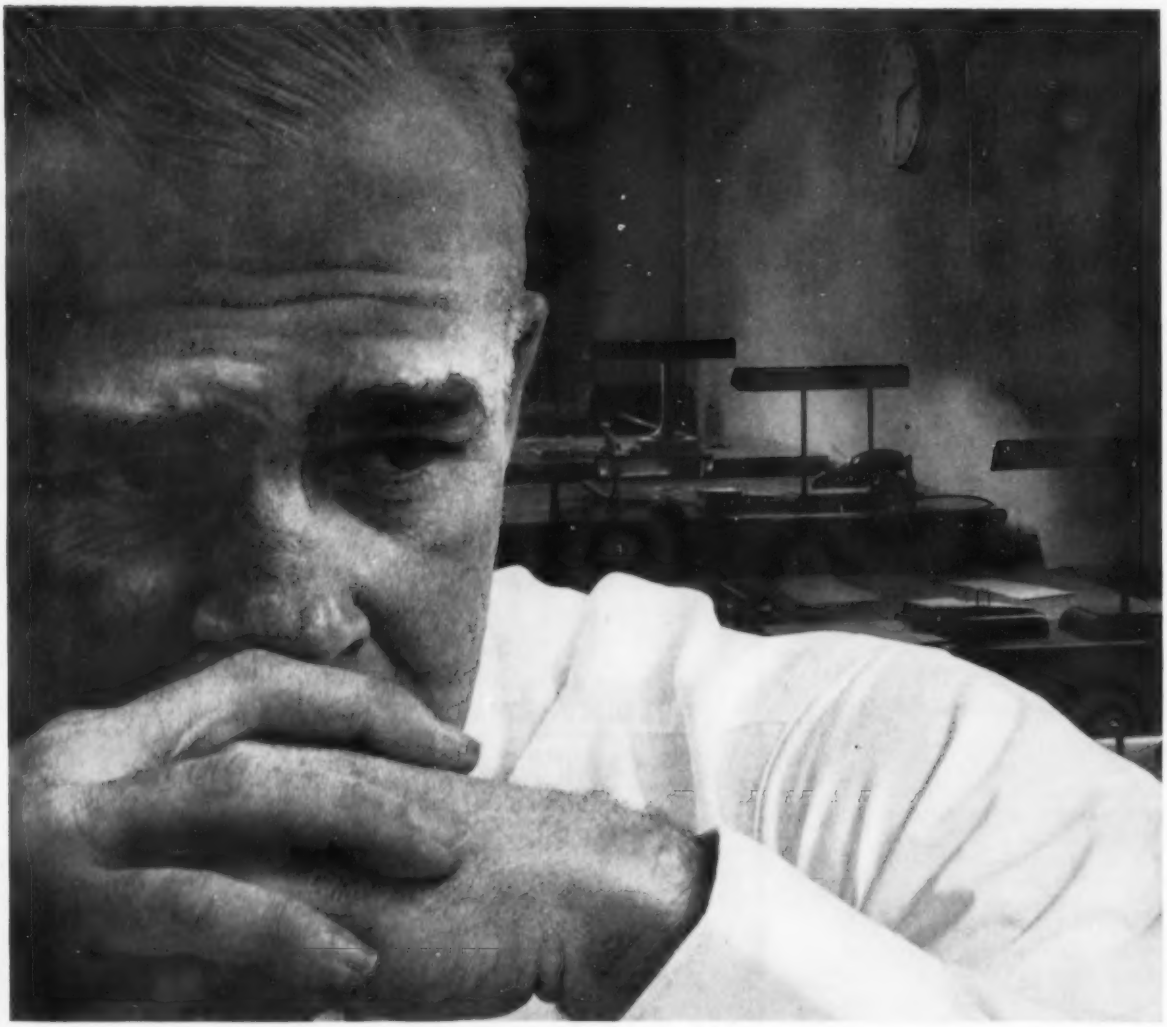

Do you worry about conduit space for new control circuits

AFTER EVERYONE'S GONE HOME?

If you have a problem in getting additional control circuits in existing conduits — here's one practical way to solve it — specify and use Rockbestos PNR 600 volt control cable. It will help you get a maximum number of control circuits in a minimum amount of space. Here's why:

- Rockbestos PNR lets you pull a 12 conductor control cable in conduit which is now carrying ordinary six or seven conductor cable.
- It's 46% smaller in area — 28% smaller in diameter than conventional control cable.
- With it you save on conduit and fittings, cut installation costs.
- It's flexible from 167° to −67° F.
- It's light, easy to handle, pull through conduits.

Get the complete Rockbestos PNR story — write now for catalog which gives complete specifications and application data.

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PNR
Small Diameter
Control Cable

MORE THAN 10,000,000 FEET IN SERVICE

HOW LEVITON BRINGS YOU BETTER PRODUCTS, SAVES YOU MONEY

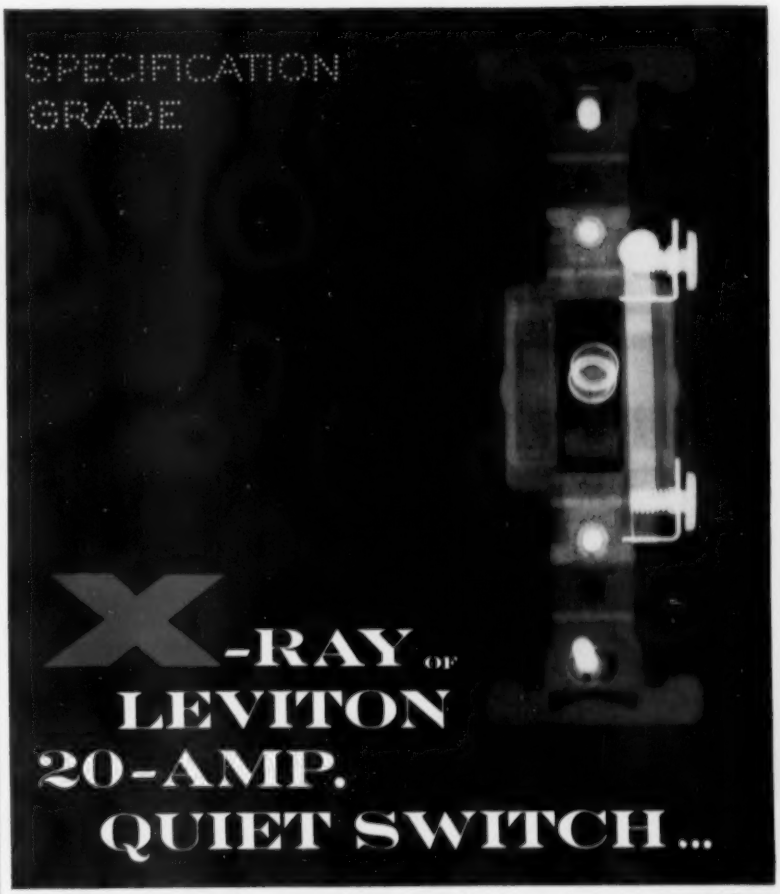
There are many good reasons why you are assured finer quality electrical wiring devices when you specify Leviton.

World's most complete line—One of the largest manufacturers of electrical wiring devices, Leviton maintains four plants, staffed by over 5,000 specialists, manufacturing 10,000 different items. Gives you one source for all your wiring needs, including all specification grades.

Complete quality control—from raw material to finished product. Each component part is precision manufactured and rigidly inspected during every stage of manufacture. Insures uniformly superior quality, *better products.*

Leviton's large, ultra-modern Testing Laboratory—helps you keep pace with future developments. Also, existing products are constantly tested and improved. Leviton continues to develop new processes which maintain superior quality while keeping prices at the lowest possible level.

Leviton—a name backed by nearly half a *century of experience*—can always be specified with confidence. Test Leviton wiring devices against comparable products of any other manufacturer. Discover Leviton's superiority for yourself. Product samples are available on request. Write today—Leviton Manufacturing Company, Brooklyn 22, N. Y.



exposes superior quality, design and construction

Ratings: 20 A.—120-277 V. Single pole, double pole and 3-way, AC only. Also available in 15 Amp. single pole and 3-way. Listed by UL, CSA and meets Federal specifications.

What you don't see counts, too! Leviton rigid quality controls assure you of specification grade 20 amp. heavy duty quiet switches that outperform your most demanding requirements. Compare this new Leviton switch on any basis you desire. You'll be convinced that grade for grade, performance for performance, Leviton superior quality stands out. Look at these special features . . .

Versatile—Fully enclosed flush tumbler switch . . . operates *in any position.*

Durable—Will withstand high inductive loads of fluorescent systems, and take full rated capacity of tungsten filament lamp loads . . . Takes full load currents up to 80% of the switch ratings for motor control.

Long-Lasting—Heavy gauge steel plaster ear straps riveted to housing, thereby providing a permanent assembly. 20-Amp. Quiet Switches will outlast ordinary 20-Amp. switches due to simpler, more durable construction.

Reliable—New design includes a magnetic arc-snuffing action at the fine silver contact points, assuring years of extra service.

Easy to Install—Large head brass terminal screws accommodate No. 10 conductor. Comes with mounting screws inserted in strap.

Quick Identification—Red body cover for easy identification.

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For full information write:

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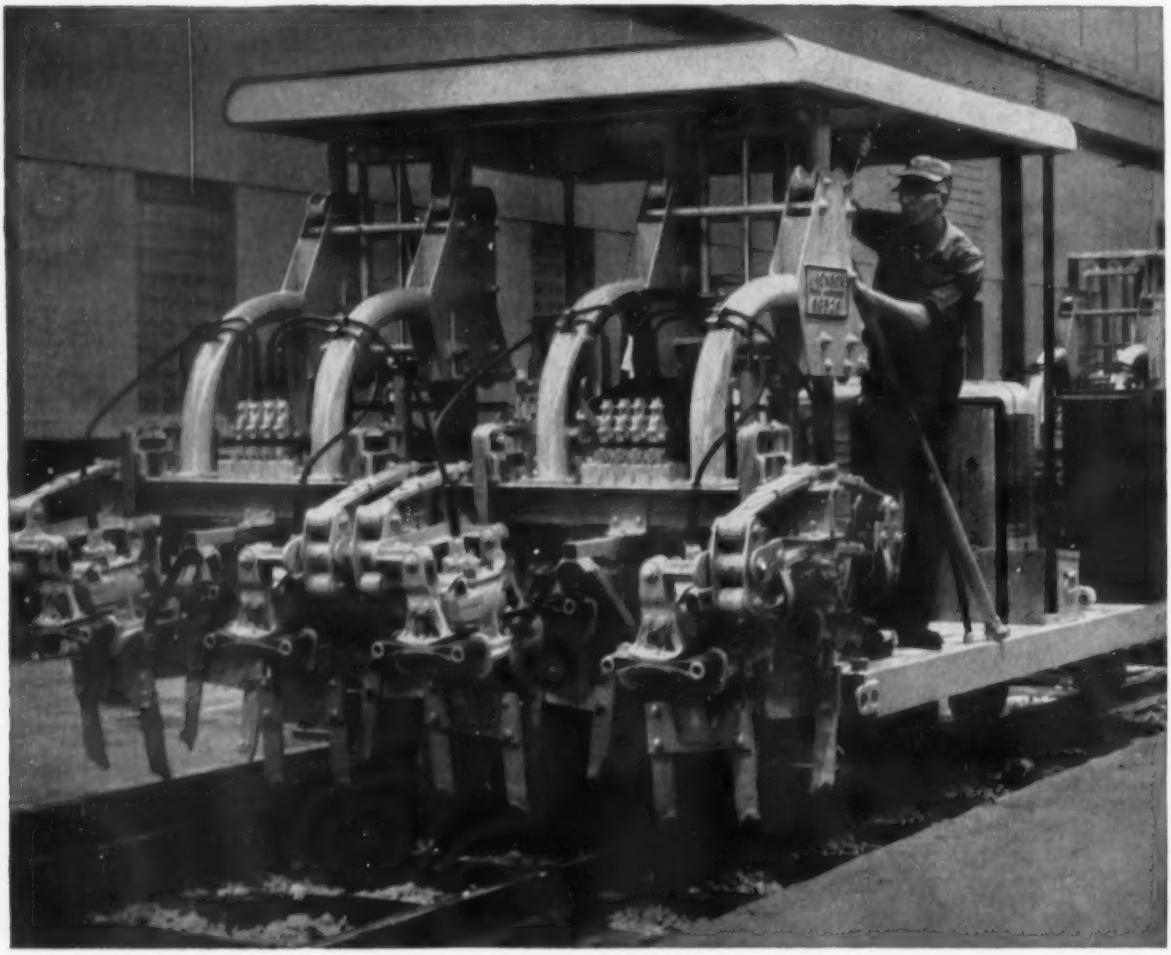
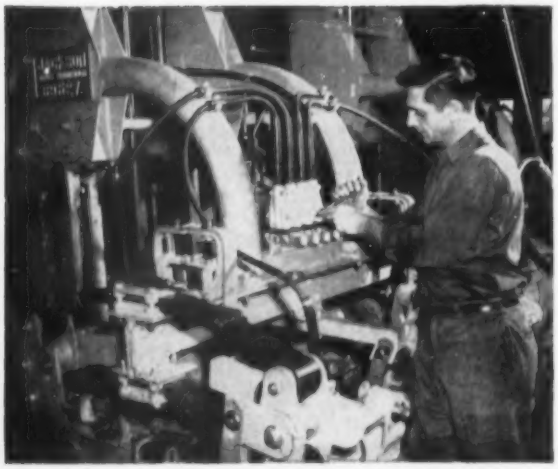
LEVITON

For Best Results Use Wire By American Insulated Wire Corporation

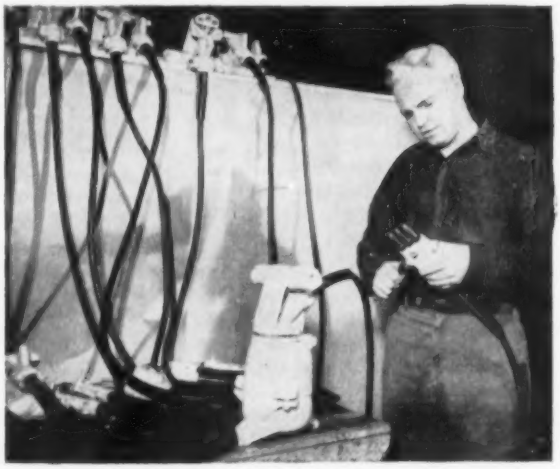
"Tiger Brand Amerclad is the most



The completely self-contained Jackson Track Maintainer.



Tightening connectors. Machine delivers 4500 ⅞ ton blows per minute.



Assembling leads. Each vibrator delivers ¾ ton blow.

durable cable we've ever used"

says **ELECTRIC TAMPER & EQUIPMENT CO., Ludington, Michigan**

MANY years ago, the executives at Electric Tamper & Equipment Co. found out that when railroads order a piece of machinery, they expect it to last a long time—without breakdowns. Since then, Electric Tamper has won a high place in industry by producing a line of the hardest-working, *toughest* track maintenance machines on the market.

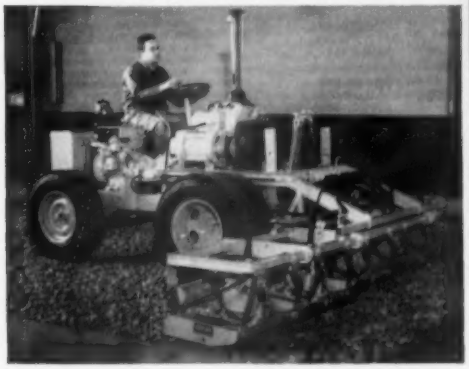
Leader of the line is the Jackson Track Maintainer, used for tamping ties. It has 8 powerful vibratory motors that drive 8 tamping assemblies. Each motor is powered with Tiger Brand Amerclad cable. The vibration and flexing (which are very severe) caused previous cable to crack until the jackets actually peeled away from the conductors. So they asked American Steel & Wire for advice.

Tiger Brand Amerclad was the solution. Finely stranded conductors soak up vibration and allow greater flexibility than ever before. The tough, well-cured jackets are impervious to oil, grease and the burning sun.

In the company's own words, "Tiger Brand cable is certainly superior to anything we have ever seen for this class of service. Its complete dependability under all service conditions has definitely helped us to maintain our good reputation in the field."

Do you want a *better* electrical cable—engineered for your equipment? Just call your American Steel & Wire representative.

The Jackson Multiple Compactor for consolidation of granular soil.



Hand Vibrospade. Cable usually drags on the ground.

Small compactor. See why they need durable cable?

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO

COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS TIGER BRAND ELECTRICAL WIRE & CABLE

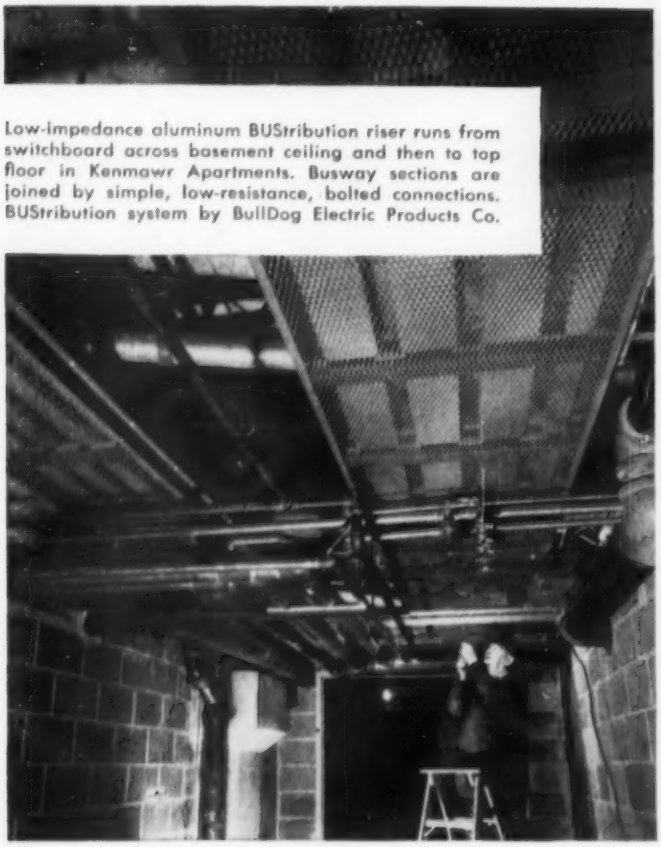
A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB

- asbestos wire and cable
- mold cured portable cord
- shovel & dredge cable
- paper & lead cable
- varnished cambric cable
- interlocked armor cable
- special purpose wire & cable
- aerial, underground and submarine cable

USS

UNITED STATES STEEL

Low-impedance aluminum BUStribution riser runs from switchboard across basement ceiling and then to top floor in Kenmawr Apartments. Busway sections are joined by simple, low-resistance, bolted connections. BUStribution system by BullDog Electric Products Co.



Aluminum busway doubles electrical capacity of new apartments with only slight increase in cost

Kenmawr Apartments in Pittsburgh is an eight-floor, 240-unit building that provides occupants with both electrical cooking and air conditioning. These two additional services almost doubled the load requirements originally conceived for the building.

Changing from conventional conduit and cable to an aluminum busway system permitted this increased load without appreciably increasing the original estimated system cost.

Seventy-five feet of 2,000-amp low-impedance aluminum risers run from main switchboard to top floor. Five busways on each floor run to locations where meters are installed for each apartment.

Another 130 feet of 1,000-amp busways serve the building's own facilities (heat, light, elevators, pumps, laundry).

Aluminum busways offer major savings when compared to a copper duct system. Cost, weight and installation figures are all substantially lower. Compared to cable and conduit, cost is much lower and the space saving is impressive.

When you need a modern, flexible, economical electrical system with high capacity, specify busways made with *Alcoa*® Aluminum . . . and *save*. All major manufacturers of busway systems offer units made with low-cost, high-conductance Alcoa Aluminum. Aluminum Company of America, 2302-H Alcoa Building, Pittsburgh 19, Pennsylvania.

General Contractor:
Larson Construction Co.

Electrical Contractor:
Devlin Electric Co.

Busway:
BullDog Electric Products Co.

Your Guide to the Best in Aluminum Value

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- Concentric Center Post and Spring Carrier exactly centered in body.
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- Special Fibre Thrust Washer.
- Die-cut Ratchet and Actuator —highest quality insulation material.
- Extra quality Bead Chain and Carrier with Stop Ball.
- Commutator—accurately die-formed of finest electrical bronze — broached center bearing for positive trouble-free performance.
- Stationary Contacts of spring bronze—lubricated for long life, easy operation.
- Heavy terminals correctly angled for easy wiring.
- Glazed Chain Hole for quiet easy pull. Chain's positive snubbing action protects mechanism.
- Ratchet Angle precisely formed for positive action.
- Highest Quality Porcelain Body.
- Highest quality electrical copper Screw Shell.
- Center Contact — spring bronze formed for positive contact with lamp base.

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VASTLY SUPERIOR MECHANISM . . .

Finely tooled parts of highly selective material, precision-engineered, insure longer trouble-free life, fewer call-backs, completely satisfied customers. One-piece design assures quick, easy installation.

67 years' experience and strict adherence to superior standards are behind every P&S Electrical Wiring Device. Write Dept. S-3 for details on any of the long line of P&S Devices.

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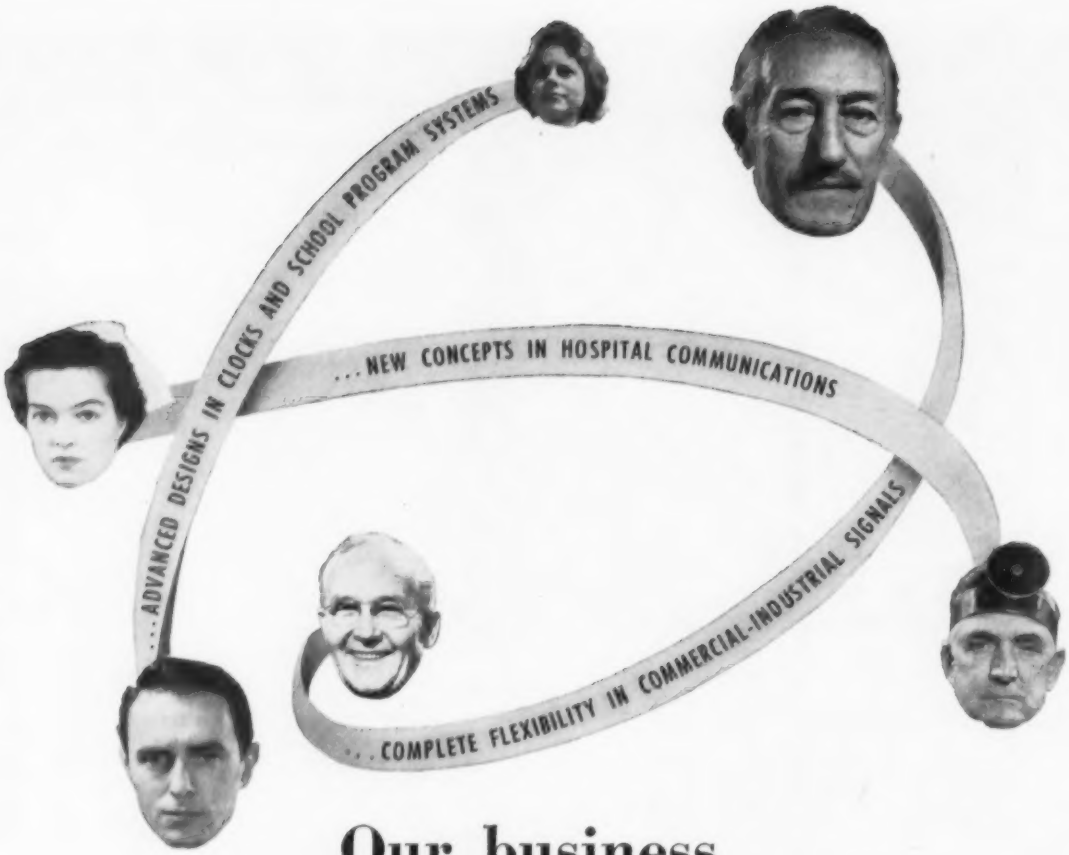
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The cost of labor must be figured into the original cost of conduit if you have to pay workmen to chase conduit threads which have rusted in your storage. That's why Pittsburgh Standard's Hot-Dip Galvanized Conduit with *hot-dip galvanized threads* is the least expensive conduit . . . threads just can't get rusty. This happy result is made possible by the world's most modern conduit mill, Pittsburgh Standard's Morrisville plant. The process developed at Morrisville has now been extended to cover Etna production on all sizes through 6 inches. You can get shipping and price information by writing or calling your nearest Pittsburgh Standard wholesaler or *Pittsburgh Standard Conduit Co., 61 Bridge Street, Pittsburgh 23, Pa.*

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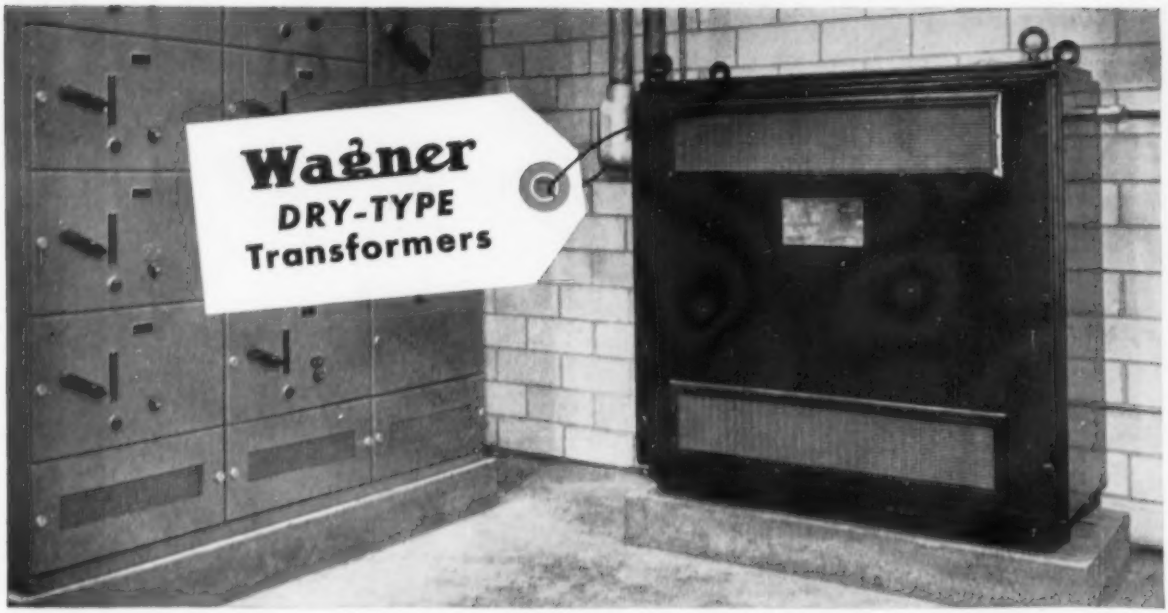
RIGID STEEL CONDUIT • ELECTRICAL METALLIC TUBING • ELBOWS • COUPLINGS • FITTINGS



Put the right voltage where you need it!

NO EXPENSIVE RE-WIRING. Wagner dry-type transformers, when installed close to your machines, portable tools, and lighting circuits, give you the right voltage for use directly from 460 or 600 volt power lines. No re-wiring is necessary—line losses are reduced—installation costs are low.

SAFE TO USE—EVEN IN HAZARDOUS AREAS. You need no fireproof vaults or other protective enclosures, since Wagner dry-type transformers meet all safety requirements for indoor installation. These transformers are liberally designed to carry overloads safely in emergencies.

PROVIDE FLEXIBILITY FOR CHANGING REQUIREMENTS. Dry-type transformers, 3 through 300 kva, are built with Wagner Form W core and coil assemblies. This design permits less weight per kva with correspondingly small cases that are easy to install—easy to move whenever changes in plant facilities are required.

ECONOMICAL TO MAINTAIN. These units have no liquids, valves, gaskets, or gauges to cause maintenance problems. The totally-enclosed types are completely sealed from all contaminating materials by sheet steel cases. Maintenance is reduced to the minimum.

Single-phase, 150°C Rise. 3 through 50 kva. Silicone insulated, totally-enclosed, non-ventilated. For indoor or outdoor use. 80°C Rise—15 through 100 kva. For indoor use only.

Three-phase, 80°C Rise. 9 through 300 kva. Ratings through 30 kva are suitable for indoor or outdoor use. Larger ratings are for indoor use only.

Single-phase, 55°C Rise. 1, 1½ and 2 kva. For indoor or outdoor use. Bulletin TU-57 gives full information. Write today.

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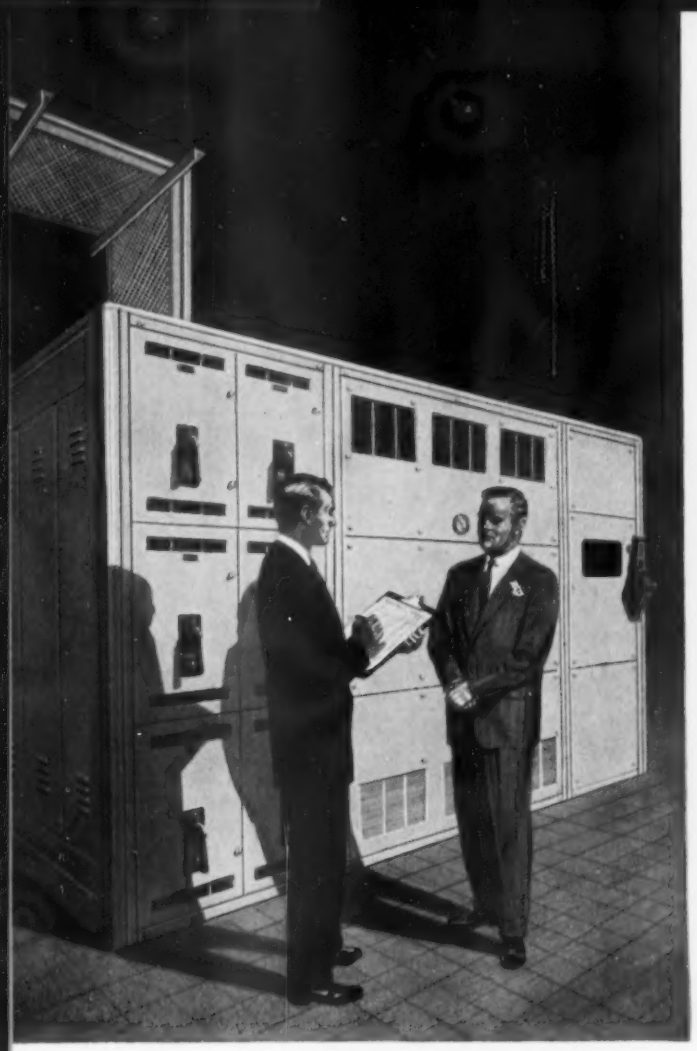

Exclusive Lo-X Scarf-lap Construction provides rigidity and strength. Tailored lengths overlap and bolt together easily. Elbows, tees and cross sections permit installation to fit specific plant layouts.

The BullDog field engineer stands ready with the detailed information you and your customers may well welcome in planning an efficient power network for new or existing facilities. Take advantage of his know-how in your planning.

Aluminum Lo-X—profitable key to electrical efficiency!

Leading industrial plants everywhere are using BullDog aluminum Lo-X feeder duct as a vital part of their electrical distribution systems. Invariably—it provides the efficiency and flexibility that add to *your* reputation with clients.

You save—your client saves—when you install Lo-X BUStribution® duct! The lightweight, prefabricated aluminum sections cost less—are easy to bolt into overhead runs, saving installation time and money. Next, current-carrying costs are the lowest possible . . . maintenance is reduced to a minimum. Finally, if plant needs change, Lo-X can be relocated without loss. Consult your BullDog field engineer—he'll show you how a complete BullDog system, from safety switches to unit substations, provides the top efficiency, economy and convenience that earn you new and repeat business.

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BullDog Electric Products Company, Detroit 32, Michigan • A Division of I-T-E Circuit Breaker Company • *Export Division:* 13 East 40th St., New York 16, N.Y. • *In Canada:* BullDog Electric Products Company (Canada), Ltd., 80 Clayson Rd., Toronto 15, Ontario.

IF IT'S NEW . . . IF IT'S DIFFERENT . . . IF IT'S BETTER . . . IT'S

BULLDOG

ELECTRIC PRODUCTS COMPANY

A DIVISION OF I-T-E CIRCUIT BREAKER COMPANY

Tests Prove

Low Sound Level. High Efficiency

Constant tests prove that ALL Sorgel dry-type transformers have low sound levels and high efficiency. These have been outstanding features in Sorgel transformers for many years; in fact, we are the originators in establishing low sound levels which we guarantee to be well below the established standards in ALL ratings up to 3000 Kva, and all voltages up to 15,000 volts.

Completely modern testing facilities enable us to prove the sound level, efficiency, temperature rise, and performance of Sorgel transformers before installation.

Because of their quiet operation, ALL Sorgel dry-type transformers are adaptable for any indoor installations—especially where low sound level is an important factor.

The liberal design of Sorgel dry-type transformers results in high efficiency at all loads, and they will carry an overload during an emergency at a safe operating temperature.

Sorgel sound-rated transformers are time-tested, and are specified by discriminating engineers and users everywhere.

Available in all standard and intermediate ratings—¼ Kva to 3000 Kva, up to 15,000 volts.

Sorgel transformers are also incorporated in substations. Available with any type or make of switchgear, or from any substation manufacturer.

Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 836 West National Ave., Milwaukee 4, Wisconsin

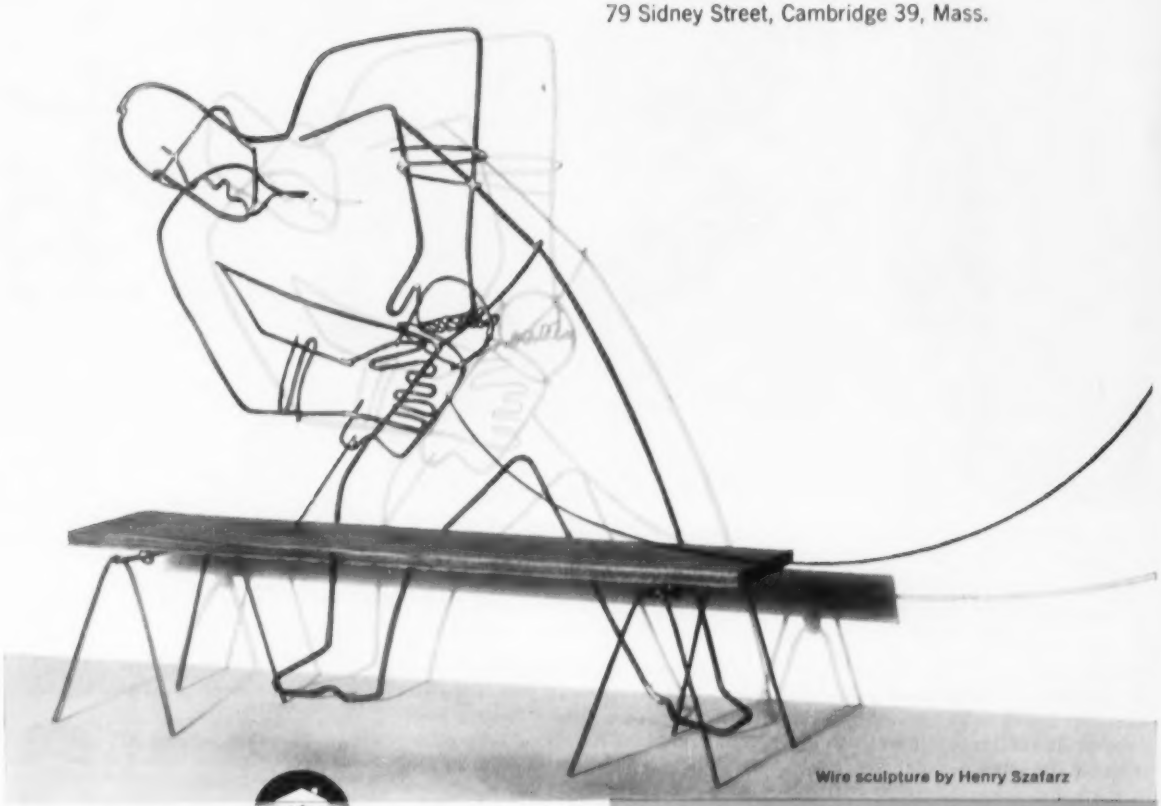
40 years' experience in the development, manufacturing and application of transformers

"Week-end Wizard"

The spirit of do-it-yourself has made us a nation of handy men. At the same time, it has sharpened our appreciation of power tools and equipment: Simplex-TIREX cords and cables, for instance. These expertly engineered cords and cables are on the job everywhere: in home workshops, in factories, in mines, and on giant construction projects.

TIREX cords and cables, newly improved for greater flexibility, feature cured-in-lead Neoprene Armor that resists abrasion, oil, heat and water . . . gives longest service.

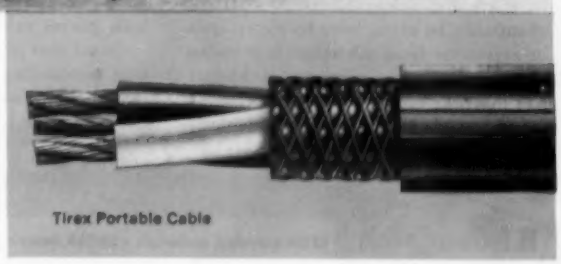
SIMPLEX WIRE & CABLE CO.,
79 Sidney Street, Cambridge 39, Mass.



Wire sculpture by Henry Szafarz

LIVE BETTER ELECTRICALLY

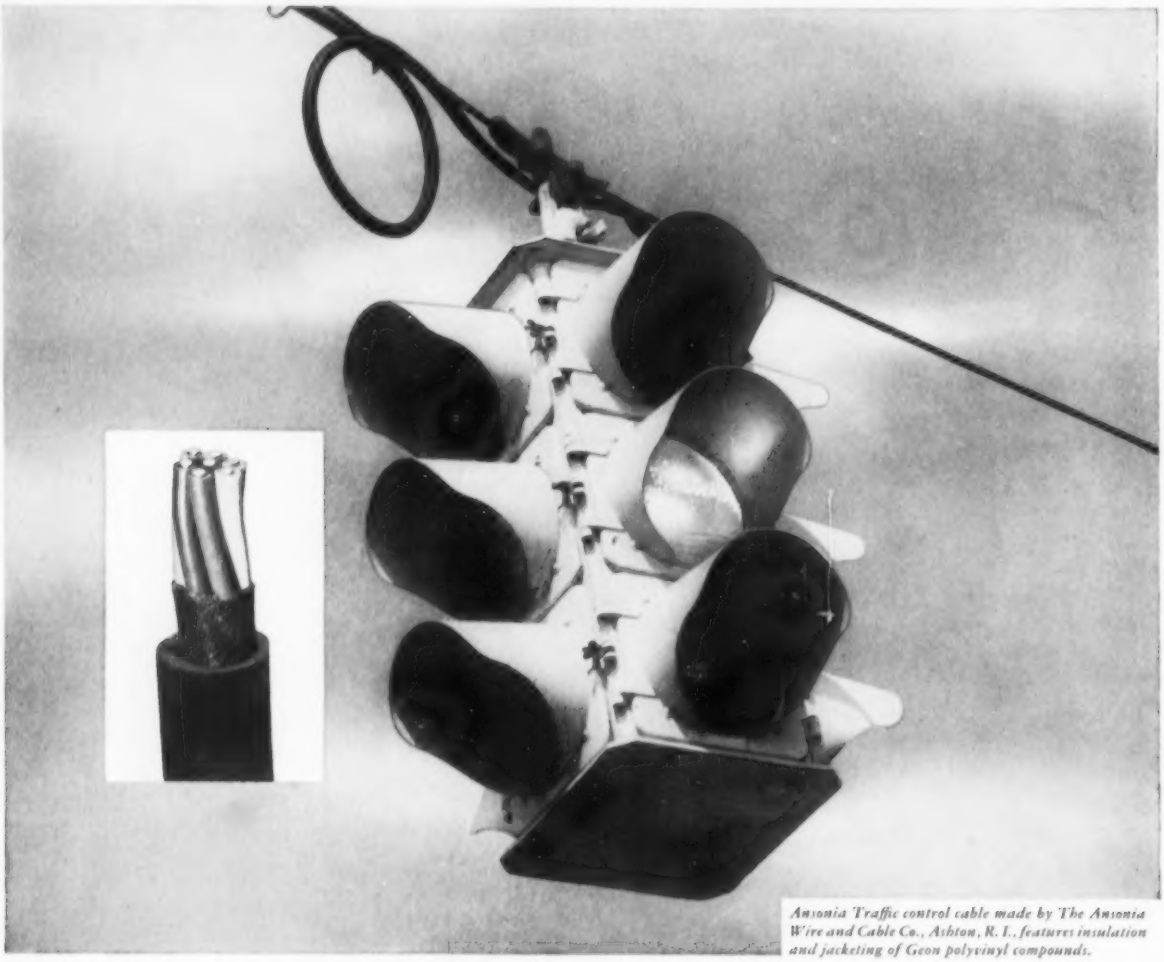
Simplex



Tirex Portable Cable

Another new development using

B.F.Goodrich Chemical *raw materials*



Ansonia Traffic control cable made by The Ansonia Wire and Cable Co., Ashton, R. I., features insulation and jacketing of Geon polyvinyl compounds.

cable with insulation of Geon helps tame traffic

THIS traffic cable with insulation and jacketing made of Geon polyvinyl materials has as many advantages as it does conductors. It is lightweight, easy to install and splice, has no braids to rot or wick moisture, no lead to corrode chemically, be eaten away by electrolysis or crystallize from vibration. It is resistant to oxygen, ozone, temperature changes and the sun's rays.

Insulation and jacketing compounds of Geon are strong, weatherproof and keep their exceptional properties with age. They resist flame, will not support combustion and have good flexing properties. Their resistance to oil, grease and air-borne acids, alkalies and other chemicals proves valuable in industrial areas.

On all *your* jobs, use the advantages of this outstanding cable and wire covering. For information, write Department GF-4 B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

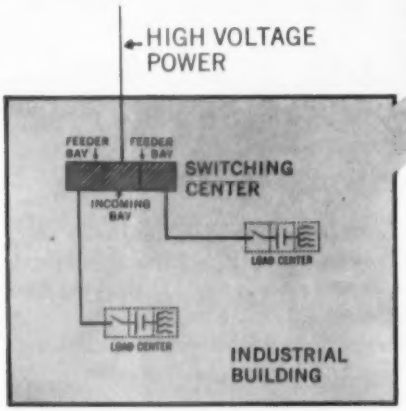
B.F.Goodrich GEON polyvinyl materials • HYCAR American rubber and latex • GOOD-RITE chemicals and plasticizers • HARMON colors

FOR INDUSTRIAL HIGH-VOLTAGE POWER CIRCUITS—

buy the right protection in your switchgear—buy S&C Metalclad Switchgear—Save 50%

Industrial circuits do not have transient faults. They cannot be re-energized immediately after an outage.

Hence costly circuit breakers are unnecessary. S&C Power Fuses give the right protection.



A typical industrial high-voltage distribution system. The darkened area represents the functional position of such a switching center as shown above in the Squibb installation.

The new switching center for the E. R. Squibb and Sons Antibiotic Laboratory and Manufacturing Plant at New Brunswick, N. J.—a division of Olin-Mathieson

For industrial high-voltage power circuits, conductors run in cables or conduits. They are not exposed to lightning, falling trees, rodents, wind, or ice which typically cause transient faults.

Consequently, the only faults that occur are permanent faults and S&C Power Fuses give the right protection against them.

The quick reclosing feature of expensive circuit breakers is of no value here.

S&C Metalclad Switchgear—by using S&C Power Fuses rather than circuit breakers, and by incorporating load interrupters for full load switching—brings substantial savings in switchgear costs—sometimes as much as 50%.

LIVE BETTER ELECTRICALLY

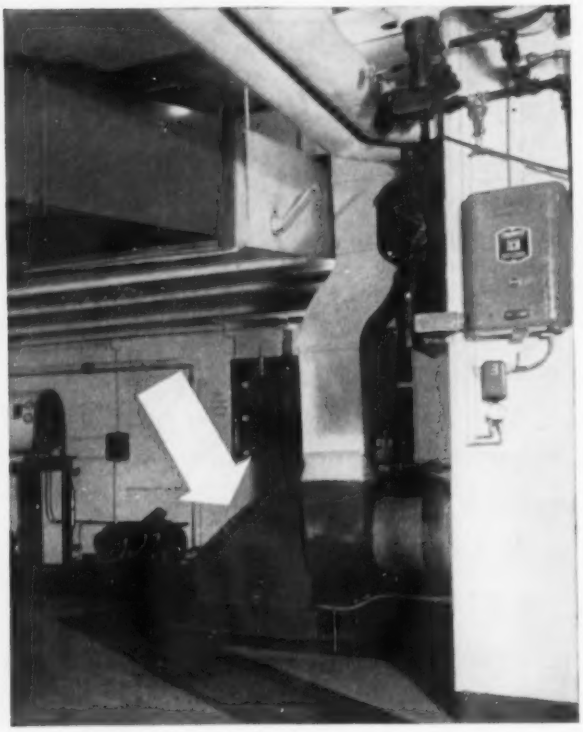
Specialists in High-Voltage Circuit Interruption for Utilities Since 1910

S&C ELECTRIC COMPANY

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

4433 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.
In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ont.

FROM TELEPHONE BOOTHS . . . TO INDUSTRIAL PLANTS



. . . here's the most versatile package unit that ever solved a ventilating problem!

American Blower Utility Set

We call them utility sets because they handle such a wide variety of ventilating problems.

Self-contained, American Blower Utility Sets, in a wide range of sizes and capacities, are used to supply or exhaust air in a wide variety of applications requiring a duct system. That means from small-capacity driers, laboratory exhaust systems, to the supply and exhaust requirements in hard-to-reach areas of public buildings, apartments, schools, hospitals, or industrial plants.

As individual package units, they are easy to install, economical to operate. And they're engineered by American Blower—specialists in the design and manufacture of air-handling and air-conditioning equipment for over 75 years. Call our nearest branch office today for full information; or write: American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

AMERICAN BLOWER

Division of AMERICAN-Standard

Specify PHELPS DODGE HABIRITE-INSULATED ARMO-LOK CABLE

Phelps Dodge Armo-Lok cable with Habirite (butyl rubber) insulation—a companion to Phelps Dodge Varnished Cambric insulated interlocked armor cable—is more than "just another interlocked armor cable."

Habirite—developed through years of Phelps Dodge experience in the design and manufacture of high voltage cables—is a specially engineered butyl rubber compound. It far surpasses any other type of rubber insulation for dependable service.

Habirite offers these distinct advantages over other rubber insulations:

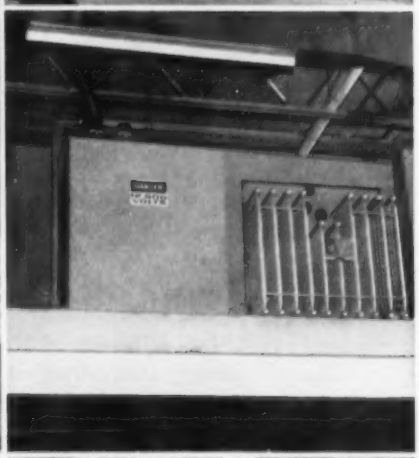
- Far greater resistance to heat and oxidation with consequent higher temperature rating and lower conductor size and cable cost.
- Far greater resistance to ozone found around high voltage equipment.
- Far greater mechanical toughness.
- Better electrical properties affording a greater safety factor in operation.
- Highest uniformity due to controlled uniformity of raw material.

★ ★ ★

See your Phelps Dodge distributor for information on a complete Armo-Lok system. For catalogue and specification data on Habirite or Varnished Cambric insulated Armo-Lok cable, write: Dept. EC, Phelps Dodge Copper Products Corporation, 300 Park Avenue, New York 22, N. Y.

PHELPS DODGE COPPER PRODUCTS CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Boston, Buffalo, Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Detroit, Fort Wayne, Greensboro, N. C., Houston, Jacksonville, Kansas City, Mo., Los Angeles, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.



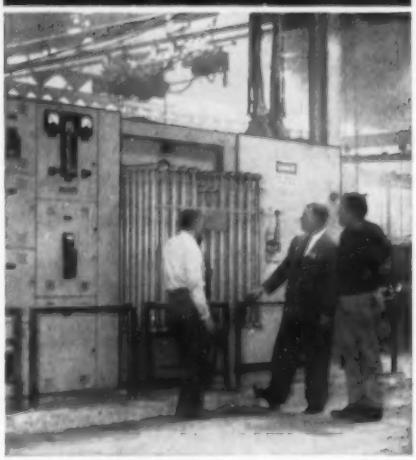
Consulting Engineers: Shaw, Metz and Dolio Electrical Contractors: Aldridge Electric Company

Johnson Motors Choose Kuhlman For New Multi-Million Dollar Plant

With the completion of this new ultra-modern plant at Waukegan, Illinois, Johnson Motors, the nation's leading manufacturer of outboard motors, now claims the largest captive die casting operation in the world.

The electrical energy for operating the Johnson plant is supplied by Kuhlman Saf-T-Kuhl load center transformers (see illustrations), chosen to meet the requirements of the new plant.

Like these engineers, you'll find Saf-T-Kuhl's quiet operation, safe performance and compact styling ideal for modern industry. To get complete facts and specifications, ask for Kuhlman bulletin CS-1000.



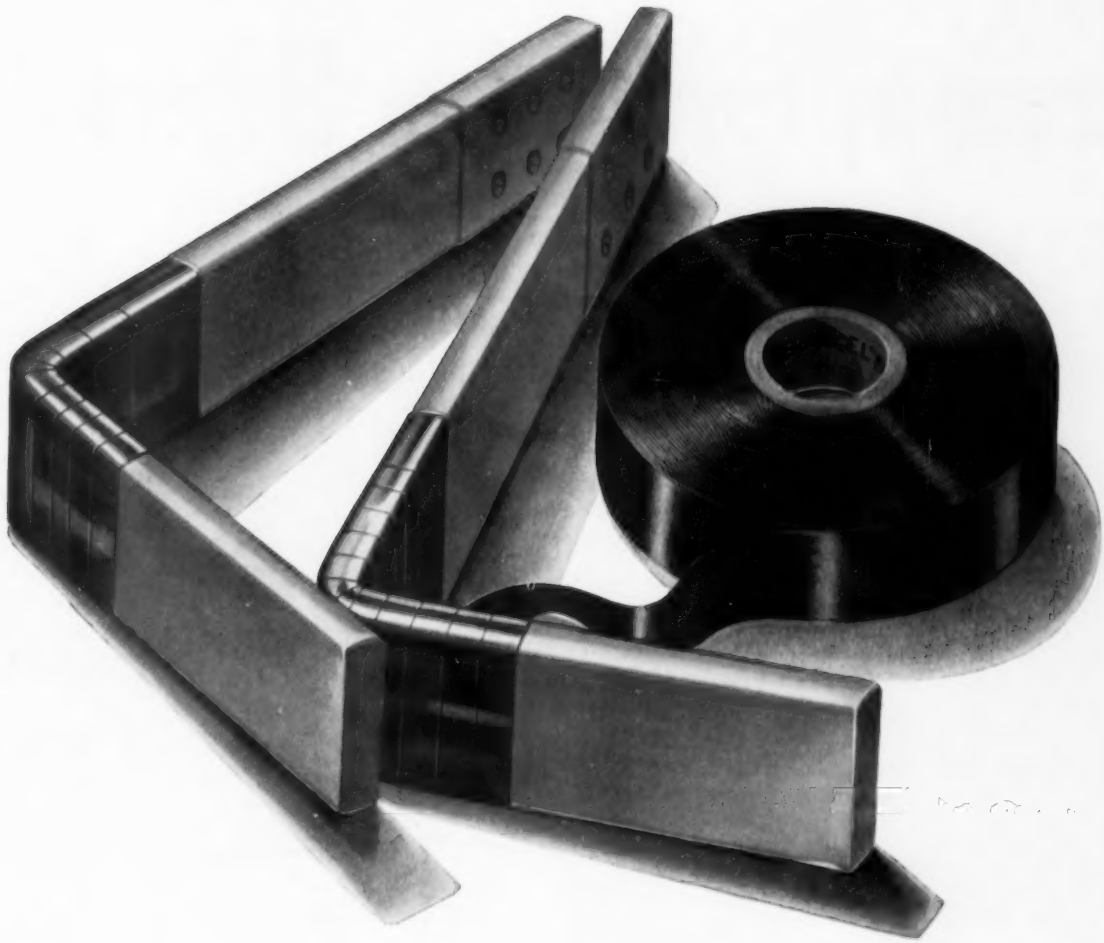
Typical Kuhlman installations in the new Johnson plant . . . engineered and installed to provide optimum performance under all production conditions.

5719

KUHLMAN ELECTRIC COMPANY

GENERAL OFFICES: Birmingham, Michigan

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA



whatever the job . . .

SELF-STICKING

PERMACEL® TAPE

PERMACEL LEPAGE'S products

Permacel Tape Corporation, New Brunswick, N. J. • a Johnson & Johnson company

Here's Why . . .

Silicone Insulation Offers New Economy For Outdoor Motors

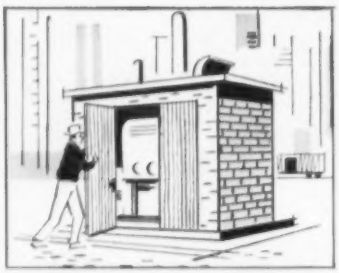
Silicone insulation is establishing a trend towards less costly enclosures for outdoor motors. By readily withstanding moisture and contaminants circulated in ambient air, silicone insulation makes possible more open enclosures and lower motor cost per horsepower.

Several leading electrical equipment manufacturers now offer a line of silicone-insulated "all-weather" motors in most large horsepower ratings.

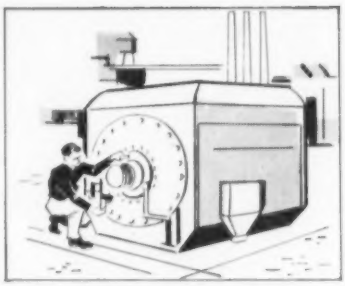
Safe, reliable operation outdoors the year 'round is assured by Dow Corning silicone insulation. Experience has shown silicone-insulated motors readily withstand torrential rains, hurricane winds, corrosive fumes, wind-driven dust, snow, sleet, cold and heat.

Long insulation life is assured by the water-repellent silicone-insulated windings that survive even flooding. Silicone insulation on motors, generators and transformers provides up to 50% greater service factor for absorbing overloads, adds immeasurably to reliable operation and increases insulation life 10 times or more. That's why it's wise to—

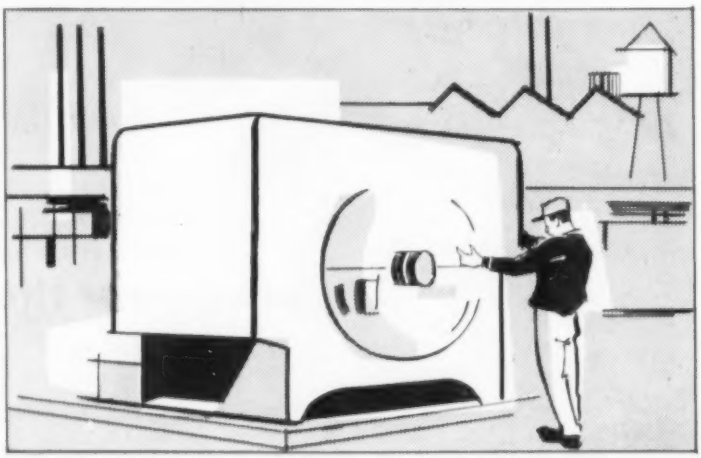
SPECIFY DOW CORNING SILICONES *and Save*



Initially, motors were sheltered in buildings . . .



Later, motor enclosures themselves sealed out surrounding atmosphere



Now, silicones protect motor parts permitting the circulation of ambient air and lower-cost enclosures.

first in silicones

Dow Corning CORPORATION

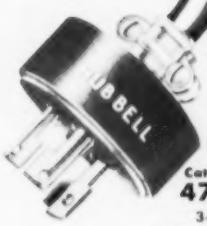
MIDLAND, MICHIGAN

Atlanta • Boston • Chicago • Cleveland • Dallas • Detroit • Los Angeles • New York • Washington, D. C.

The First and Only *Twist-Lock*®

APPROVED FOR GROUNDING PURPOSES *ONLY*

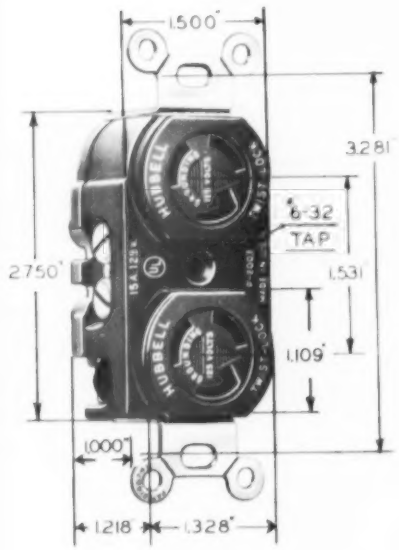
15 AMP.
125 VOLT



Cat. No. **4720**
3-wire
125V Rubber Cap

Another Hubbell Exclusive

The 4700 Series "Twist-Lock" units shown at left represent the *only approved line of locking devices meeting Code requirements for 125 volt grounding.* By installing these devices, the user cannot make the often fatal mistake of plugging into a 3-phase circuit by accident. Once and for all, these devices eliminate the danger of mistaking single phase plus ground with a 3-phase circuit. Leaving nothing to chance, each unit is specifically designed for *grounding only,* thereby completely preventing interchange with regular "Twist-Lock" units.

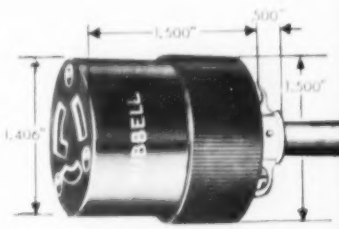


A Complete New Line—Non-interchangeable With Regular "Twist-Lock" Units

The "Twist-Lock" equivalent of the 5262 line of Straight Blade Grounding devices.

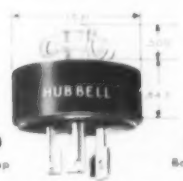
For Applications that Require Positive Grounding plus Positive Locking

Elbow-shaped Grounding Slot Prevents Insertion of Regular "Twist-Lock" Caps



Cat. No. **4700**
3-wire, 125 Volts
Duplex Receptacle

Cat. No. **4730**
3-wire, 125 Volts
Connector Body



Cat. No. **4720**
Rubber Cap

Cat. No. **4723**
Bakelite Cap

Cat. No. **4726**
Armored Cap

New 3-wire caps are supplied with distinctive elbow-shaped grounding blade. Caps will fit 4700 Series connector bodies or receptacles only. They cannot be used with regular Twist-Lock devices.

- **Non-interchangeable with regular "Twist-Lock" units of the 7580 type.**
- **All 4700 units made in distinctive brown color.**
- **Complete line approved by U.L.**
- **The only "Twist-Lock" line designed for grounding only.**
- **Easy-to-identify green hexagonal grounding screw.**
- **Pressure grip back wiring.**
- **Rugged construction throughout.**

HARVEY HUBBELL, INC.

BRIDGEPORT 2, CONNECTICUT

FACTORY WAREHOUSE LOCATIONS ASSURE NATIONWIDE STOCK AVAILABILITY

Bridgeport 2, Connecticut
State and Bostwick Streets

Chicago 7, Illinois
37 South Sangamon Street

Los Angeles 12, California
103 North Santa Fe Avenue

San Francisco, California
1675 Hudson Avenue

Dallas 7, Texas
1111 Dragon Street

NOW...

you can be sure

IT'S GROUNDED

15 AMP.—125 VOLT

Twist-Lock®

FOR

GROUNDING PURPOSES

ONLY

Thanks to National Electrical Code grounding regulations and the introduction of special devices with U-shaped grounding blade (⏊) it is now possible to eliminate accidents caused by inserting a cap wired for single phase plus ground into a 3-phase circuit receptacle. An exception to this has been in the important area of locking connectors. Anticipating this special problem, Harvey Hubbell, Inc., now introduces a complete new line of "Twist-Lock" for *grounding purposes only*. This new line is non-interchangeable with regular "Twist-Lock" because of a distinctive elbow-shaped grounding slot which prevents the insertion of regular "Twist-Lock" caps. This new 4700 Series "Twist-Lock" line is designed for 125 V. applications that require positive grounding plus positive locking—for example: portable electrical tools, appliances, electric typewriters, water coolers and other electrical machines and equipment. By installing these new "*grounded only*" units, fatal accidents sometimes caused by plugging into a 3-phase circuit can be eliminated.

Play it safe by installing Hubbell quality wiring devices in your office or plant. Complete information on this new line of "Twist-Lock" grounding devices is available on request.

HARVEY HUBBELL, INC.

BRIDGEPORT 2, CONNECTICUT

WIRING DEVICE WAREHOUSE LOCATIONS ASSURE NATIONWIDE STOCK AVAILABILITY

Bridgeport 2, Connecticut
State and Bostwick Streets

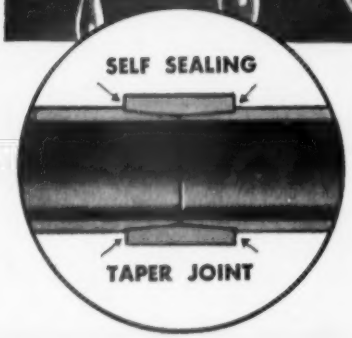
Chicago 7, Illinois
37 Selvin Sangamon Street

Los Angeles 12, California
103 North Santa Fe Avenue

San Francisco, California
1675 Hudson Avenue

Dallas 7, Texas
1111 Dragon Street

WATERTIGHT!



Orangeburg Fibre Conduit Prolongs Cable Life

Keep out corrosive ground waters, and you prolong the life of underground cables, say utility engineers!

Why? Because ground waters containing corrosive elements derived from the soil and concrete encasement attack cable sheath and shorten cable life. Orangeburg's impermeable wall and self-sealing Taper-Sleeve Joint shed them *"like water off a duck's back."* You get maximum protection with Orangeburg.

Orangeburg protects cables in many other ways. Smooth bore, low co-efficient of friction reduce incidence of abrasion. Its material is strong, tough, resilient, durable.

No other conduit is easier to install

Light, 8-foot lengths and a complete line of bends and fittings speed installation. Taper-Sleeve Joints tap water-tight in a jiffy. Orangeburg lays faster and at lower cost than any other type of conduit.

Orangeburg Fibre Conduit has prolonged cable life at minimum expense for utilities, municipalities and industry since 1893.

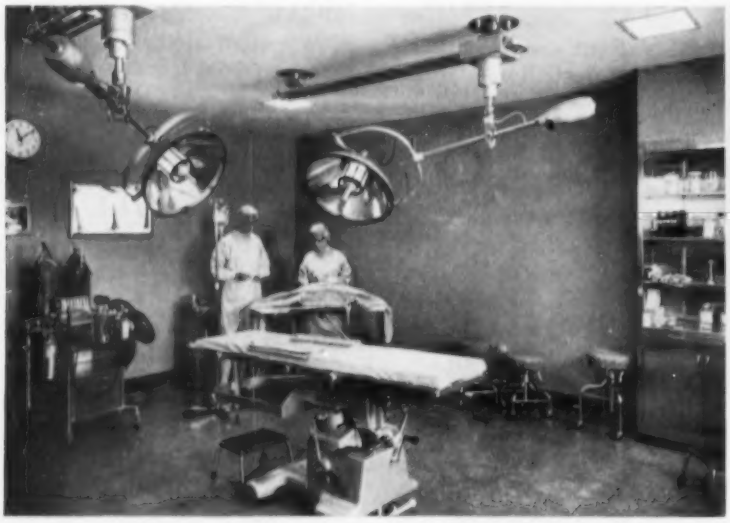
Distributed by Graybar Electric Company and by General Electric Supply Company. Branches and stocks in principal cities.

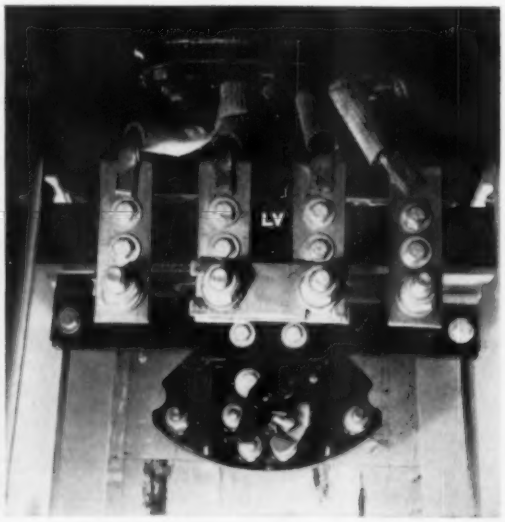
WRITE DEPT EC-87 FOR CAT. 52

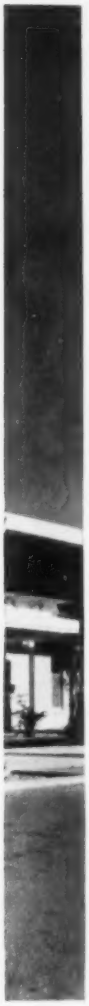
ORANGEBURG MANUFACTURING CO., INC., Orangeburg, N. Y. **West Coast Plant, Newark, Calif.**

ORANGEBURG®
FIBRE CONDUIT

Hacienda-like appearance of St. Luke's Hospital belies the modern surgical miracles that are performed within . . . miracles performed in an aura of silence . . . a silence which DS-3 transformers help to maintain.







NEW single-phase dry-type transformer

INSTALLED IN HOSPITAL GIVES NO DECIBEL READING . . . EVEN WITH METER ON TRANSFORMER SURFACE!

Absolute quiet must be maintained in the surgical areas of a hospital. The Westinghouse DS-3 transformers installed next to the surgical X-ray rooms of the new Louis Galland Memorial Wing of St. Luke's Hospital, Phoenix, Arizona, fulfill these standards of silence. So quietly do they perform that with meter scale at 40 db, no reading whatever could be taken, even when the meter was placed on the surface of the transformer.

Sound absorption. A new mechanical vibration dampening system floats core and coils independent of base, case and connecting conduit. Even with rigid conduit, no noise is transmitted to mounting equipment and conduit.

Smaller, more efficient. Two Westinghouse exclusives—inorganic Silclad insulation and grain-oriented Hipersil® steel cores—reduce size up to 11%, weight up to 32%, as compared with previous 80°C units.

Long, trouble-free service life. Case temperatures are no higher than for 80°C transformers, are lower than Underwriters' standards. Reduced heat offers additional savings in longer component life, greater overload capacity. This is especially important in high ambient areas, such as the Phoenix, Arizona, location of St. Luke's Hospital.

For complete information on the DS-3 transformer, call your local Westinghouse salesman or distributor, or write Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

J-70809

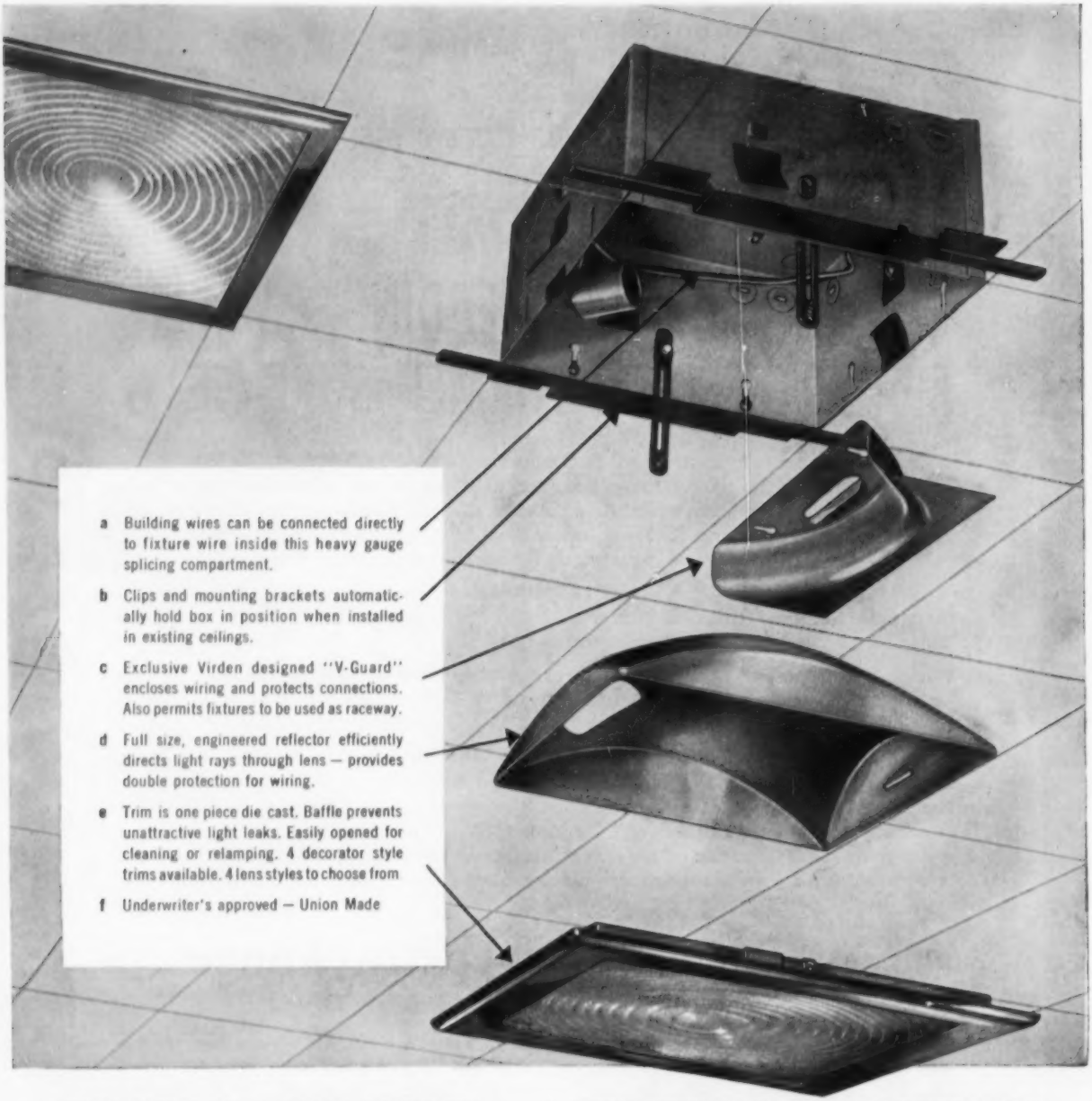
YOU CAN BE SURE... IF IT'S Westinghouse

If your plant is a victim of undervoltage, it's time to POWER-UP. Ask your Westinghouse representative or your utility power sales engineer for specific recommendations to fit your problem.

Left—Although this DS-3 transformer is located only a few short feet away, perfect operating room quiet is maintained at all times.

Center—Tap changer permits secondary voltage correction in seconds—a twist of the wrist adjusts secondary voltage for changing load conditions—another exclusive from Westinghouse.

Right—Rigid conduit can now be used with DS-3 transformers; the vibration dampening system completely eliminates noise transmission to conduit and mounting equipment. This transformer shows no rise in sound level, even when decibel meter is placed on top surface.


a Building wires can be connected directly to fixture wire inside this heavy gauge splicing compartment.
b Clips and mounting brackets automatically hold box in position when installed in existing ceilings.
c Exclusive Virden designed "V-Guard" encloses wiring and protects connections. Also permits fixtures to be used as raceway.
d Full size, engineered reflector efficiently directs light rays through lens — provides double protection for wiring.
e Trim is one piece die cast. Baffle prevents unattractive light leaks. Easily opened for cleaning or relamping. 4 decorator style trims available. 4 lens styles to choose from
f Underwriter's approved — Union Made

AVAILABLE IN 4 TRIM FINISHES — 4 LENS STYLES IN ANY COMBINATION

Polished Copper with Bent Decorator Glass
Satin Aluminum with Fresnel Lens
Polished Brass with Albalite Lens
Chromium with Drop Opal Glass

3 SIZES

75-Watt 8 x 8 x 5 Housing	100-Watt 10 x 10 x 5 Housing	150-Watt 12 x 12 x 5 Housing
9¾ x 9¾ Trim	11¾ x 11¾ Trim	13¾ x 13¾ Trim

VIRDEN proudly presents the FIRST RECESSED FIXTURE that is INTERNALLY-PREWIRED!*

A major improvement by Virden! Now for the first time *all* wiring connections can be made within the fixture itself. No external outlet box to wire in. Standard house wire is entirely suitable for connections inside the housing. What's more, the unit can be used as a raceway if desired. And it has full Underwriter's approval.

The secret is Virden's exclusive design shown opposite. All parts assemble into one compact, square housing, permitting easier installation especially in areas with close quarters. The patented "V-Guard" covers all connections eliminating the need for an external outlet box. The specially engineered full size reflector not only improves lighting efficiency but serves as an added safeguard for the wiring.

In 3 sizes — 75 watts, 100 watts and 150 watts — the unit features a one-piece die cast trim, baffled to eliminate light leaks. Four trim finishes with four lens styles provide a wide range of decorative lighting possibilities, both indoors and out.

Use this new Virden fixture on your next lighting job. See for yourself how much easier it is to install, the wiring time it saves. Your Virden distributor has these new fixtures in stock now. Order yours today.

(*Patent Applied For)

FOR NEW WORK OR OLD – RESIDENTIAL OR COMMERCIAL

The compactness of this new Virden recessed fixture makes it an excellent unit for new work. It requires a minimum of space. Has mounting brackets and adjustment slots for a tight fit on ceilings. Ample knockouts for fast wire connections. (hanger bars optional)

This new Virden fixture is ideal for installation in existing ceilings, too. Simply cut a hole ⅛" wider than the housing, insert in opening and wire. The special spring clips hold the housing snugly when used in conjunction with the mounting brackets.

The new Virden recessed fixture is excellent for commercial and residential use. Installation costs less and the 4 lens styles and finishes available make possible a wide range of efficient and decorative lighting, indoors and out.

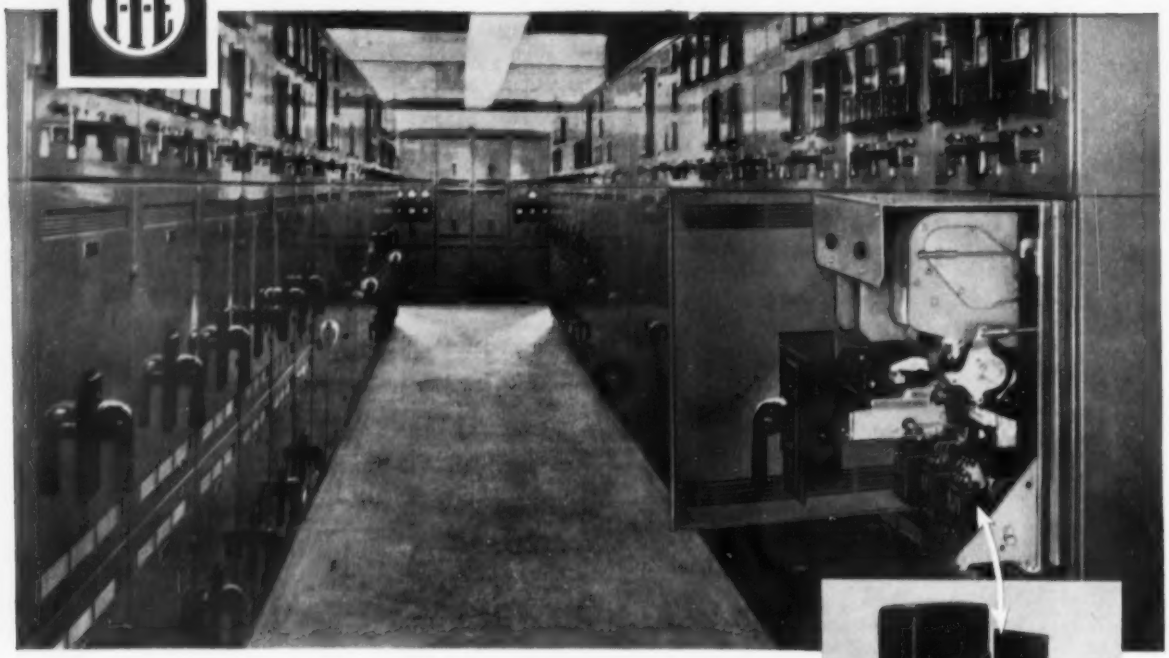
VIRDEN Lighting

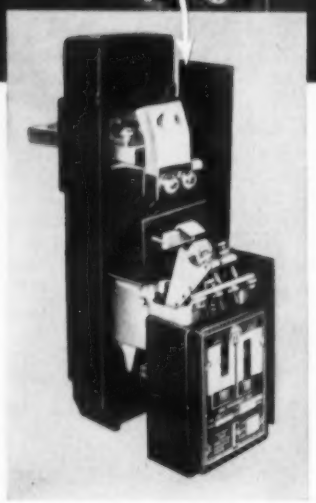
virden

John C. Virden Co., Dept. ECM, 6103 Longfellow Ave., Cleveland 3, Ohio

Member American Home Lighting Institute

LOW VOLTAGE SWITCHGEAR





Here's SENSITIVE Circuit Protection

Some temporary overcurrents are tolerable; should even be permitted to occur. But sensitive circuit protection is needed to interrupt them when they persist too long or are of too high a magnitude.

The I-T-E Type OD-1 dual magnetic overcurrent trip device gives such protection. It permits temporary overcurrents, but limits them in duration and magnitude. This device will trip the circuit breaker after a predetermined interval on relatively low overcurrents or will trip instantaneously on high-magnitude fault currents. In either case you get safe, positive protection—sensitive to the needs of the circuit and the equipment on it.

For complete information on sensitive circuit protection, including selective tripping, undervoltage and other tripping devices, contact your local I-T-E sales representative. Or write for Bulletin 6004B. I-T-E Circuit Breaker Company, 19th & Hamilton Sts., Philadelphia 30, Pa.

Features of the I-T-E Type OD-1 Trip Device

PRECISION BUILT and factory calibrated to provide the highest possible accuracy in operation.

SEALED SILICONE TIMING ELEMENT. No maintenance. No oil to handle, no level to maintain, no sludging.

QUIET. Resonant vibration dampeners prevent a-c noise and wear on parts.

COMPLETELY ADJUSTABLE IN SERVICE. The delay pickup is easily adjusted from 80 to 160% of the continuous current rating. The instantaneous pickup is adjustable from 500 to 1500% of the continuous current rating. The time delay is adjustable to any of three time delay bands—minimum, intermediate and maximum.

SAFE DEAD FRONT DESIGN. Insulated knobs permit safe adjustment on a *hot* circuit breaker.

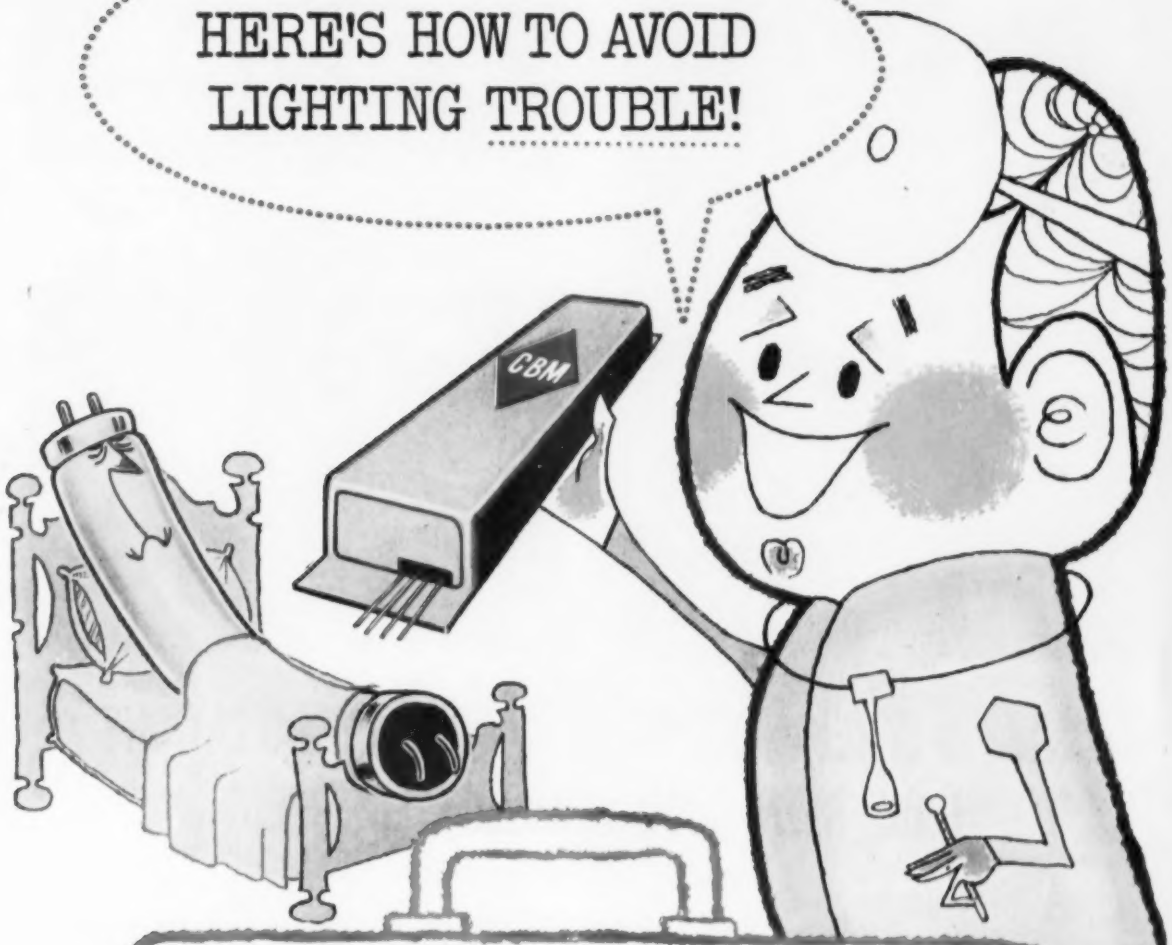
DEPENDABLE impact tripping action. The *hammer blow* movement of the time delay armature at end of timing stroke gives positive operation.

FAST RESETTING. Sensitive check valve on the piston provides quick resetting of the time delay. Repeat tripping is assured.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

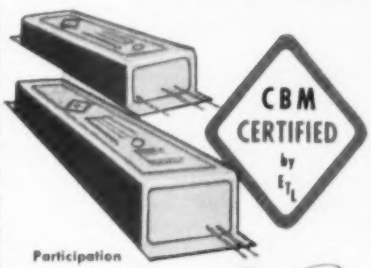
IN CANADA: EASTERN POWER DEVICES, LTD.

HERE'S HOW TO AVOID LIGHTING TROUBLE!



Poor ballasts boost total installation costs
cut ballast life and light output, too . . . so

Insist on CERTIFIED CBM *Ballasts in Fixtures*



Participation in CBM is open to any manufacturer who wishes to qualify.

With CERTIFIED CBM BALLASTS in fixtures, you get High Power Factor, save on wire and labor costs. You get quiet operation, too. And you also get assured ballast life, optimum light output and rated lamp life, as tests by the fluorescent lamp makers show.

For Certified Ballasts are made to exacting specifications "tailored to the tube" and checked by Electrical Testing Laboratories. And they're *all* UL approved. Assure top performance . . . insist on Certified Ballasts in fixtures.

Write for a copy of the new booklet that really gives you the low-down about approvals on fluorescent lamp ballasts.

Seven leading manufacturers now make up

CERTIFIED BALLAST MANUFACTURERS

2116 KEITH BUILDING CLEVELAND 15, OHIO

CBM 2-CU

Sample house, Terwood Park Homes, Upper Moreland Township, Pa. Price range is $21,000 to $23,000.

(Below), Mr. Hey explains features of G-E remote-control system to Builder, Mr. Kenneth W. Flower.

"1000 G-E REMOTE-CONTROL WIRING INSTALLATIONS HAVE BEEN GOOD BUSINESS FOR ME!"

. . . Mr. Harry G. Hey, Electrical Contractor, Ambler, Pennsylvania

"I've installed more than a thousand General Electric remote-control wiring systems in the Philadelphia area during the past three years", says Mr. Hey, "and I give them credit for bringing in a lot of fine new business.

"G-E remote-control is the type of house-selling *feature* that builders are looking for . . . not just another wiring job. Take Terwood Park Homes, for instance, a project I'm working in right now: I'm using 24 attractive G-E remote-control switches, plus a nine-position master selector switch, for each house. The public's response has been enthusiastic. Ken Flower, the builder, says 'G-E remote-control is like having an extra salesman in the model home!'

"His prospects like the convenience they get with plenty of handy G-E switches, providing multi-point switching wherever it's desirable . . . plus the security of having a selector switch in the master bedroom. One turn of this selector switch controls main bath, hallway, dining room, kitchen, den, cellar, garage, and back and front outside lights . . . floods the house quickly with light if the occupants should hear noises during the night!

"The whole system costs the builder only $78 more per house than conventional wiring . . . another big reason why I prefer G-E remote-control. It costs me the least to install of any low-voltage system. The one-transformer G-E layout saves wire, time and money in installation . . . and stands up well in service. My men have found it as easy to work with as regular wiring."

Ask your General Electric distributor to show how you can profit by installing G-E remote-control wiring systems. OR: Write General Electric Company, Wiring Device Department, Providence 7, R. I.

Progress Is Our Most Important Product

GENERAL ELECTRIC

GENERAL CABLE

BUILDING WIRE

immediate delivery through over 500 Authorized Distributors!

Make your job easier, save time and money: rely on General Cable's Authorized Distributors for prompt, on-time delivery of your wire and cable needs. Over 500 Authorized Distributors are backed up by large stocks in General Cable's Distributing Centers strategically located from coast-to-coast. For the best in quality and service, buy from an Authorized General Cable Distributor.

GENERAL CABLE CORPORATION,
420 Lexington Avenue, New York 17, N.Y.
Offices and Distribution Centers Coast-to-Coast

for quality and service... **specify GENERAL CABLE**

ROYAL PVC HEAVY DUTY CAPS AND CONNECTORS HAVE WINNING WAYS

I like PVC dead front caps—no exposed wires to worry about — no bothersome fiber washers.

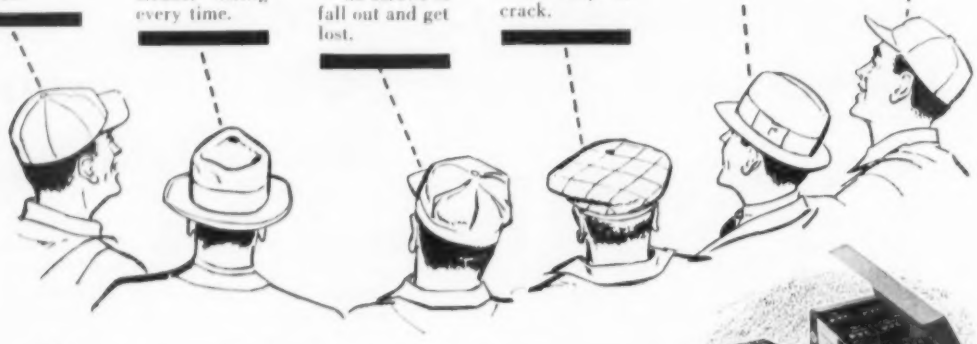
I like PVC for safety — I get better, safer, cleaner wiring every time.

I like PVC one-piece connectors — no loose eyelets or rivets — no screws to fall out and get lost.

I like PVC all-vinyl construction — they'll take a lot of abuse, but won't break, won't chip or crack.

I like PVC because they save my time — fastest, easiest wiring I ever saw!

I like PVC extra-rugged, all-molded design — blades and contacts stay put — never wobble or work loose.



Yes, the electrical trade is going for Royal PVC in a big way — the greatest engineering advance in caps and connectors in years!

FREE SAMPLE — Write on company letterhead for FREE SAMPLE today!

ROYAL ELECTRIC CORPORATION
an associate of International Telephone and Telegraph Corporation
PAWTUCKET • RHODE ISLAND

ROYAL ELECTRIC
AN ASSOCIATE OF I T & T

CHECK THESE "SPECS"

Constructed of more die-formed parts than almost any other fixture of its type for rugged performance.

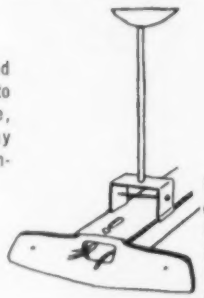
For general lighting the SIXTEEN-EIGHTY is unsurpassed for efficient long-term lighting economy.

Double acting positive spring clips retain side panels firmly to prevent rattling and to allow simple snap-in replacement.

An advanced concept of lighting comfort . . . the Sunbeam SIXTEEN-EIGHTY series has been critically engineered for the ultimate in universal application and lighting comfort.

Extruded metal rail reinforced plastic side panel to insure freedom from warpage or accidental breakage while enhancing design appearance.

Heavy gauge, die-formed end plates rigidly held to main channel. Large, smooth-edged wireway opening permits fast continuous row mounting.



For increased flexibility and ease of installation, die-formed channel accommodates sliding clamp hangers. No connectors required for continuous rows.

Translucent white plastic side panels of light stable Dow virgin #647 Styron are ribbed and contoured for architectural appeal. A 10° slant helps maintain longer lasting high efficiency and contributes to better brightness control from normal viewing angles.

CBM certified, ETL tested and UL approved parts.

90% reflectance durable baked white enamel "blends" with most contemporary ceilings.

The SIXTEEN-EIGHTY: it's easy to see by

Shielding assembly automatically disengages by means of spring-loaded latches and remains suspended from channel by jack chain for quick accessibility.

Surface or pendant mounted by use of nearly universal knockouts and sliding clamp channel.

Exacting photometric control achieves extremely high efficiency (up to 87%) with a controlled distribution of approximately 60% up and 40% down, a brightness of less than 1 c/in² within the shielded zone.

Rigidly constructed, vibration-free interlocked louver provides high, comfortable shielding of 35° x 35°—better than most school requirements.

Engineered for maximum heat dissipation for longer ballast life.

Bonderized for long-lasting corrosion resistance and tough paint adherence.

SUNBEAM LIGHTING COMPANY

777 East 14th Place, Los Angeles 21, California

For technical information on this advanced concept of lighting, write for bulletin F-2.

Ask your distributor for Youngstown Buckeye Full Weight Rigid Steel Conduit and Youngstown Electrical Metallic Tubing.

When the new addition and remodeling of Employers Mutual Casualty Company's existing office building in Des Moines, Iowa, was planned, Youngstown's "Buckeye" Full-Weight Rigid Steel Conduit was wisely specified to provide life-time positive, safe protection for the electrical wiring system.

If safe and efficient functioning of **your** electrical systems—in any location, under any condition—presents a problem, then Youngstown "Buckeye" Conduit should be specified. Satisfied users across the nation report to us: "It's much easier to bend and thread—wire fishing is less troublesome—and because its corrosion resistance is superior, we get a much longer service life."

"Buckeye" Conduit is fast becoming the specification of leading building owners, architects and contractors—why not make it yours?

Delivering is no problem—as all the better distributors in electrical and industrial markets carry complete and ample stocks. Their quick, courteous service is yours for a phone call, anytime.

YOUNGSTOWN "BUCKEYE" CONDUIT

. . . provides permanent wiring protection for remodeled Iowa building

Employers Mutual Casualty Co. Bldg., Des Moines, Iowa
Architects & Engineers: Childs & Smith, Chicago, Ill.
General Contractor: Weitz Construction Co., Des Moines, Iowa
Electrical Contractor: Weston Lighting Co., Des Moines, Iowa

Standard-threaded rigid steel conduit is the only wiring system approved today by the National Electrical Code as moisture-, vapor-, dust- and explosion-proof for use in hazardous locations and occupancies.

THE YOUNGSTOWN SHEET AND TUBE COMPANY
Manufacturers of Carbon, Alloy and Yoloy Steel
General Offices - Youngstown 1, Ohio
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GET SQUARE D SAFETY SWITCHES AND BENEFIT FROM THE NEW NEMA STANDARDS

NEMA standards are adopted in the public interest and are designed to eliminate misunderstandings between the manufacturer and the purchaser, as well as to assist the purchaser in selecting and obtaining the proper product for his particular need.

Square D's quick change to the new standards gives you the performance and safety which NEMA standards assure.

Square D Safety Switches cost no more —why settle for less?

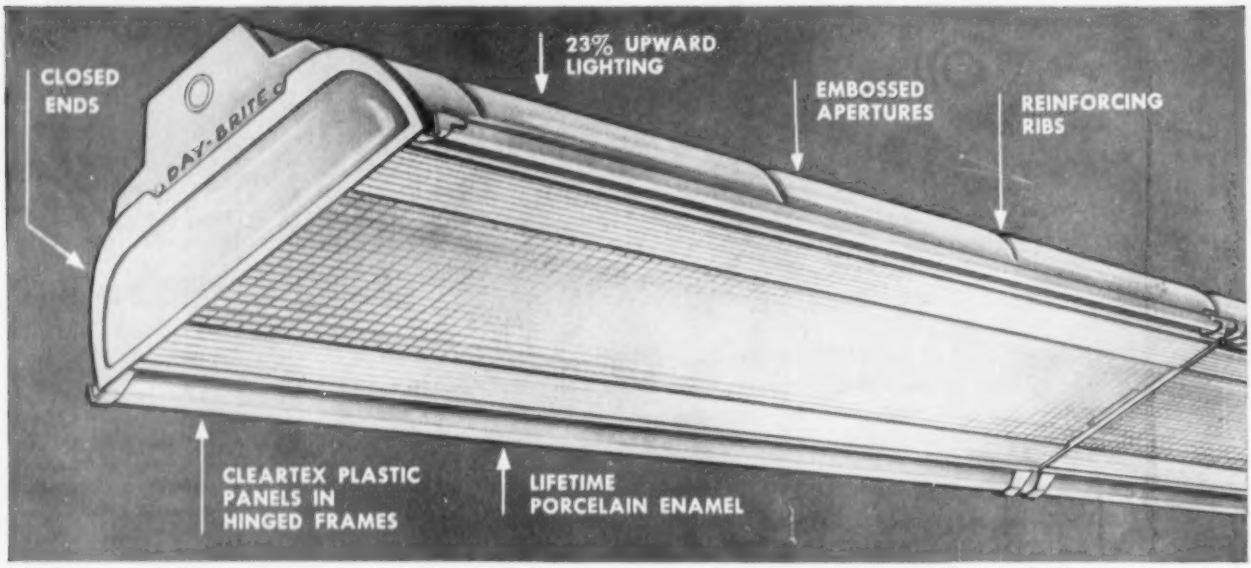
DESCRIPTION	HEAVY DUTY New	NORMAL DUTY formerly Types H, S, or A	LIGHT DUTY formerly Types D or G
Rating-Ampere Voltage	30—600 250 or 600V AC, DC	30—1200 250 or 600V AC, DC	30—200 250V AC
Enclosure	NEMA 12 • Industrial Use (Gasketed) NEMA 4 & 5 • Water-tight & Dust-tight NEMA 7 • Explosion-resisting Class I—Group D NEMA 9 • Explosion-resisting	NEMA 1 • General Purpose NEMA 3R • Raintight	NEMA 1 • General Purpose NEMA 3R • Raintight
Horsepower Rating	NEC Fuse Ratings Dual-Element Fuse Ratings	NEC Fuse Rating Dual-Element Fuse Ratings	NEC Fuse Rating
Operating Mechanism	Quick-Make, Quick-Break Independent of Handle	Quick-Make, Quick-Break Independent of Handle	Positive Make, Positive Break Spring Assisted
Cover	Interlocked & Padlock Attachment	Interlocked & Padlock Attachment	Padlock Attachment
Plating—Current Parts	Extra-Heavy Silver	Silver	
Endurance	Maximum Endurance Far Exceeds UL Standards	Exceeds UL Standards	Meets UL Standards

NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE

SQUARE D COMPANY

New DAY-BRITE power-groove industrial fixtures...

Four all-new units bring you the latest developments in Day-Brite research... higher intensities of comfort lighting for better seeing and greater money savings in your operation.



DAY-BRITE CFI-20 CLEARTEX®

A New Concept in Comfort for Industry...

a revolutionary new way to harness the high output of power-groove lamps ... the most practical, high-intensity industrial fixture designed to provide greatest visual comfort in high, medium and low bay installations.

...for higher foot-candle levels with greatest visual comfort, without annoying reflected glare, for better seeing.

CFI *Means Comfort for Industry*

DECIDEDLY BETTER
DAY-BRITE
Lighting Fixtures

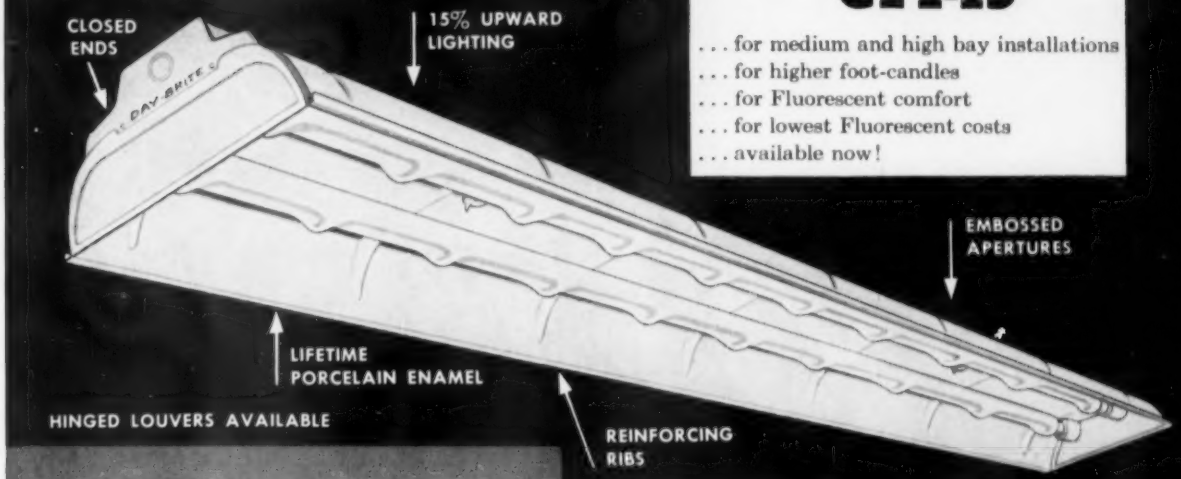
NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT

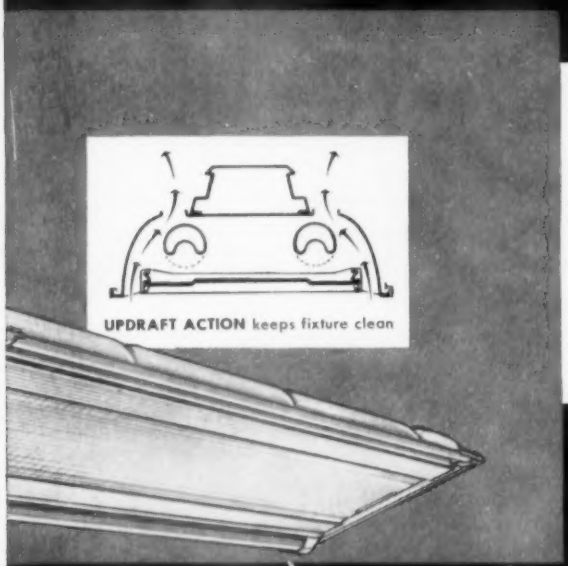
71167

DAY-BRITE LIGHTING, INC., 5402 BULWER AVENUE, ST. LOUIS 7, MISSOURI
DAY-BRITE LIGHTING, INC., OF CALIFORNIA, 530 MARTIN AVENUE, SANTA CLARA, CALIFORNIA

DAY-BRITE **CFI-15**

. . . for medium and high bay installations
. . . for higher foot-candles
. . . for Fluorescent comfort
. . . for lowest Fluorescent costs
. . . available now!

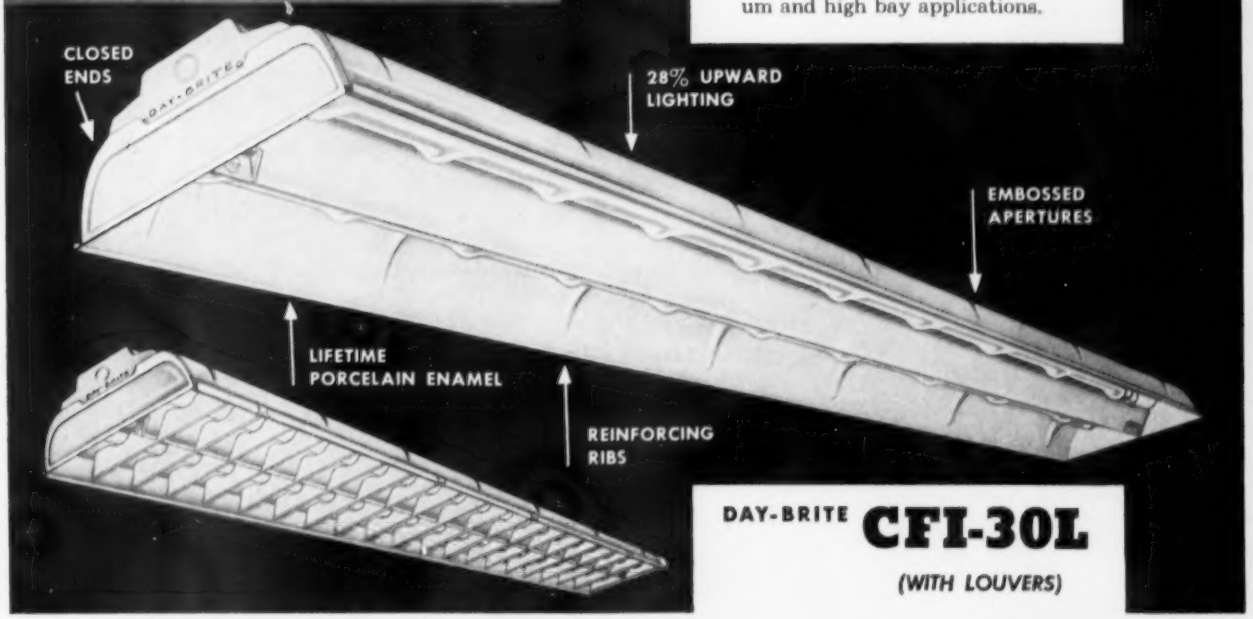




If better seeing is important, you cannot compromise on your lighting. Always insist on Day-Brite —the nation's first choice in lighting fixtures.

DAY-BRITE **CFI-30**

Offers all the outstanding features of the CFI-15 plus greater shielding for greater comfort. For low, medium and high bay applications.



DAY-BRITE **CFI-30L**

(WITH LOUVERS)

We help you "catch" more new business

When you're looking for new construction business, Dodge Reports can help you "catch" just the jobs you want . . . because Dodge Reports cover the whole field of construction, tell you precisely what jobs are coming up and when. In addition, they tell you whom to contact and when bids are wanted (even who's bidding). If you'd like to see how you can get more and better business right in the area you serve, then read and mail this coupon today.

TO: **DODGE REPORTS**, DEPT. 96, 119 WEST 40th STREET, NEW YORK 18, N. Y.

Yes! I'd like to see how to get more business by knowing in advance who's going to build, what, when, where.

I want to know whom to contact and when to submit bids.

I'd like to see some Dodge Reports, and I'd like a copy of your booklet that tells how to use this accurate, daily, up-to-the-minute construction news service.

I understand that I can pick just the area in the 37 Eastern States and the type of construction activity that interests me. Also, that I won't have to wade through mounds of data to find the information I need.

I'm interested in General Building ☐ **House Construction** ☐ **Engineering (Heavy Construction)** ☐

in the Following Area: _____

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Dodge Reports
For Timed Selling to the Construction Industry

General Electric's New Fluoroflood Fixture masters all these lighting jobs . . . and more!

Here's the fluorescent floodlight you've been looking for. Consider these features:

IT'S VERSATILE—Look at all the applications pictured! And there are many other areas all around you where this General Electric Fluoroflood Fixture will do the job best . . . in fact, anywhere you need "light by the foot or yard."

IT'S ECONOMICAL—You'll be pleased with the low price your General Electric floodlight distributor will quote. The Fluoroflood is quick and easy to install . . . the eight-foot unit weighs only nine pounds . . . it's less expensive to operate and maintain . . . lamp life is six times longer and power costs are only one-fifth those of an equivalent filament installation.

IT'S FLEXIBLE—Mount it overhead . . . mount it below . . . aim it at any angle (built-in aiming) . . . mount it directly or on brackets . . . use it open or with clear plastic cover . . . almost any combination of lengths (standard four-, six-, eight-, and nine-foot models, and others on special order) to do your job.

IT REALLY PERFORMS—Gives improved visibility . . . five times more light per watt with Power Groove lamps than from filament . . . even, uniform light distribution . . . no "hot spots" . . . cool, crisp, white fluorescent light reduces glare, gives comfortable, attractive seeing.

Get the full story of this new development in general-purpose fluorescent floodlighting! Contact your General Electric floodlight distributor or write Section 451-197, General Electric Company, Schenectady, New York.

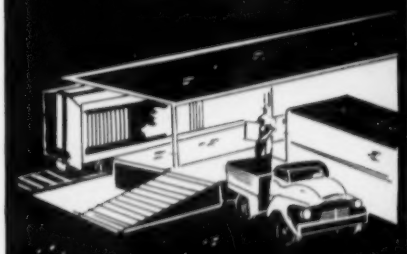
Progress Is Our Most Important Product

GENERAL ELECTRIC

Building fronts

Outdoor businesses

Plant entrances



Loading docks

Service stations

Signs

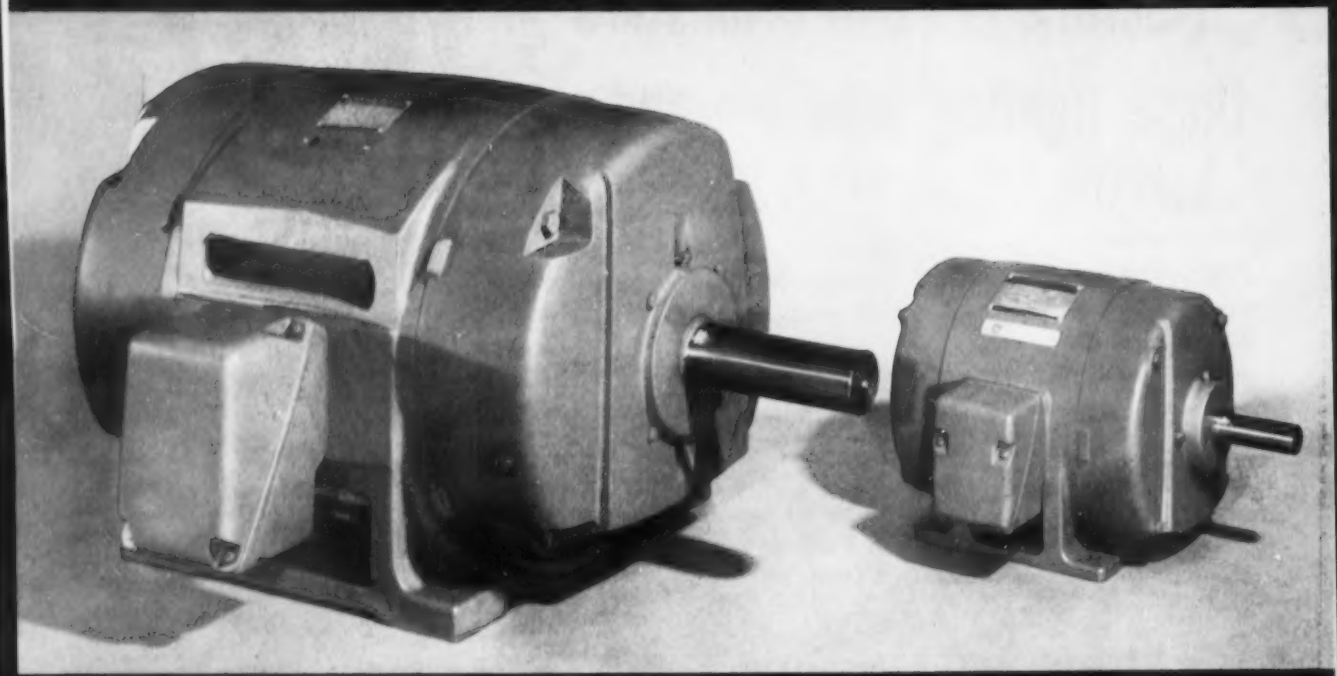
immediate shipment . . . all ratings

General Electric TRI 55 CLAD

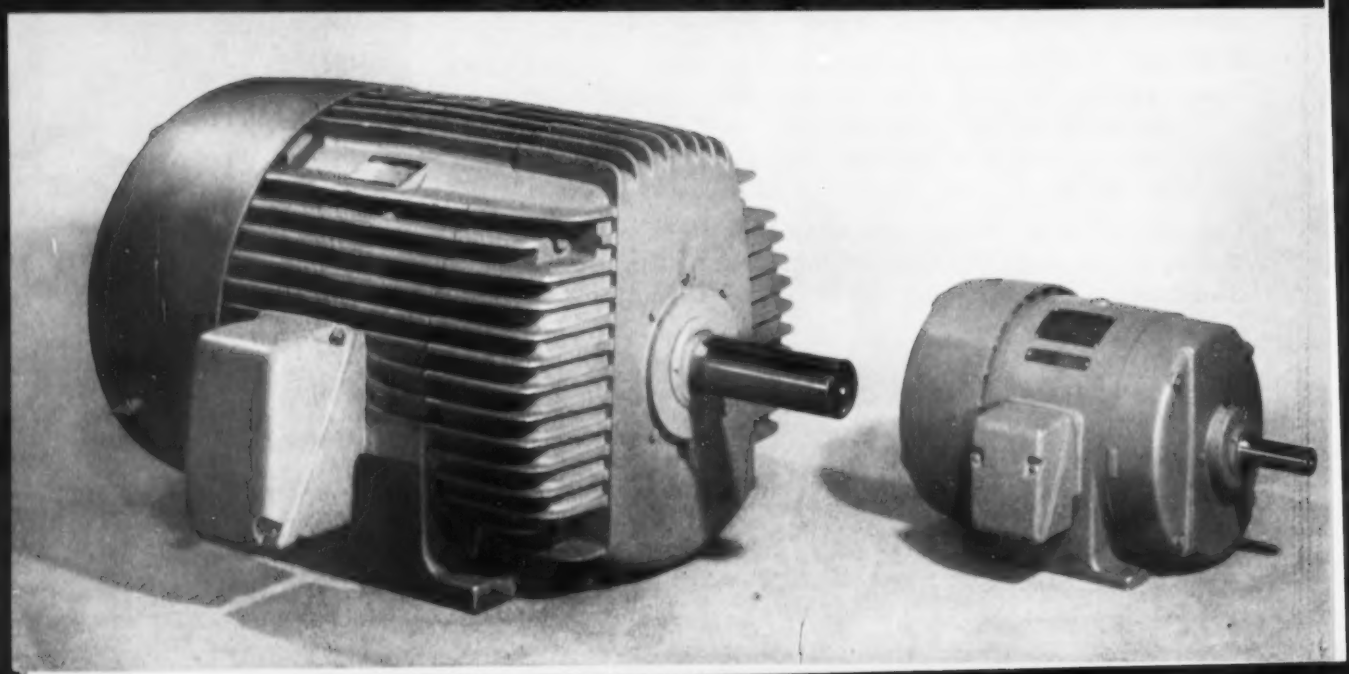
REG. U.S. PAT. OFF.

NOW UP

DRIPPROOF



TOTALLY ENCLOSED

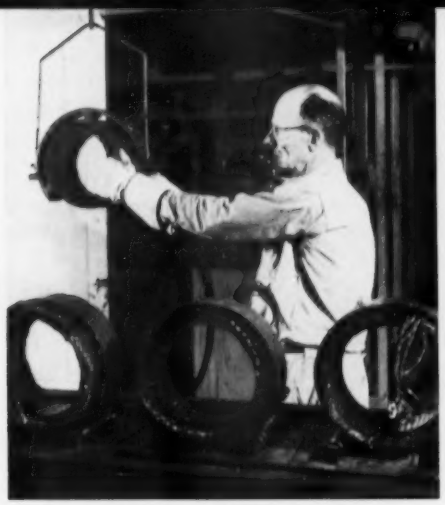


Motors in New NEMA Ratings

TO 125 HP

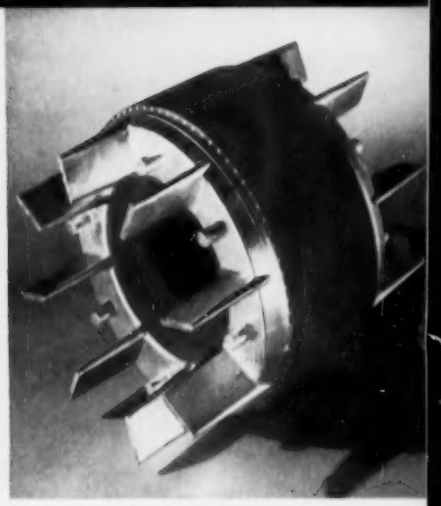
YEARS AHEAD BENEFITS

DESIGNED FOR GREATER PROTECTION—Better protected against physical damage by rugged cast-iron frame and endshields, new Tri-Clad '55' motors will handle many applications where ordinary dripproof motors cannot be applied.



BUILT TO PROVIDE LONGER LIFE—Longer stator life is provided through use of new, advanced insulation system utilizing Mylar* slot insulation, Formex® magnet wire, non-wicking Geoprene® leads and Dri-Film® silicone coating.

*Registered DuPont Co. Trade-mark.



ENGINEERED FOR TOP PERFORMANCE—Improved rotor is solid cast from commercially pure aluminum for greater strength, higher conductivity. Integrally cast rotor fans conduct heat to air stream more effectively than separately joined fans.

FOR COMPLETE INFORMATION

FOR COMPLETE DETAILS on the new line of Tri-Clad '55' motors up to 125 hp, contact your local G-E motor distributor or the sales engineer at your nearby General Electric Apparatus Sales Office. You will get expert assistance in selecting and applying the right motor for your particular application.

FOR FREE SLIDE RULE—which lets you determine at a glance the weight and space-saving benefits of recently announced NEMA standards for larger motors—and for informative, free General Electric Tri-Clad '55' motor bulletin, please send attached coupon.

Section 891-6
GENERAL ELECTRIC COMPANY
Schenectady 5, New York

Please send me the following publications:

☐ **FREE BULLETIN** (GEA-6602) describing the many advanced features of new Tri-Clad '55' motors up to 125 hp.

☐ **FREE SLIDE RULE** (GEN-148) to determine weight and space-saving benefits of new Tri-Clad '55' motors.

NAME _____

TITLE _____

COMPANY _____

ADDRESS _____

CITY & STATE _____

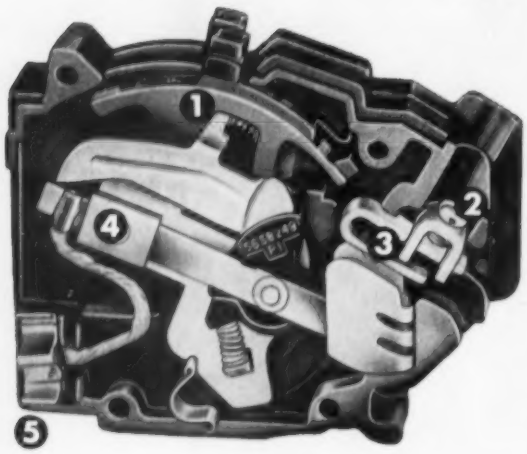
Progress Is Our Most Important Product

GENERAL ELECTRIC

New! General Electric "twin" breaker slashes costs,

Now get more circuits per load save up to 25% in equipment

Put two breakers into the same space as a regular 1-inch breaker



More built-in durability with new "twin" construction. Each pole is rated 15 or 20 amperes.

1. "Protection plus" with free floating handle. Positive control of arc direction protects the hand, prevents breaker damage.
2. No stripped threads. Steel lugs on all terminals. Threads can't be stripped, grip like a bear trap.
3. Cool, safe operation with silver-plated current carrying parts. Contacts "wipe" against each other, stay clean for longer life.
4. High-torque magnetic action. Thermal magnetic trips provide greater circuit protection, positive separation of contacts.
5. Easier, quicker breaker connections. Protected self-aligning stab receptacle is spring reinforced—can't bend, plugs in without jiggling, grips tightly.

Now you can put more circuits into a smaller load center, because the new General Electric "twin" has two rugged breakers in a one-inch case! And because new G-E load centers are sequenced-phased, you can use "twins" and regular 1-, 2-, and 3-pole breakers in almost any combination. That means you can use smaller, less costly load centers than ever before possible. Here is a typical case:

Here's how you save . . .

For a 14-circuit installation requiring

. . . one 50-ampere 2-pole breaker
. . . one 15-ampere 2-pole breaker
. . . one 20-ampere 2-pole breaker
. . . eight 15- or 20-ampere single-pole breakers

Buy G-E's 8-circuit load center (TRP810S)	@	$10.40*	$10.40
Buy 6 "twin" breakers	@	5.60*	33.60
Buy 2 Type R breakers	@	2.80*	5.60
Total cost			$49.60
Lowest previous cost (20-circuit box plus breakers)			$65.20

*List Price

You save $15.60

This is just one example of the many jobs on which you can cut equipment costs. See your General Electric Distributor now. Be sure you've got your next job figured the new "twin" breaker way.

Progress Is Our Most Important Product

GENERAL ELECTRIC

doubles circuit capacity of new G-E load centers.

center, costs

New load centers slash installation and wiring time up to 20%

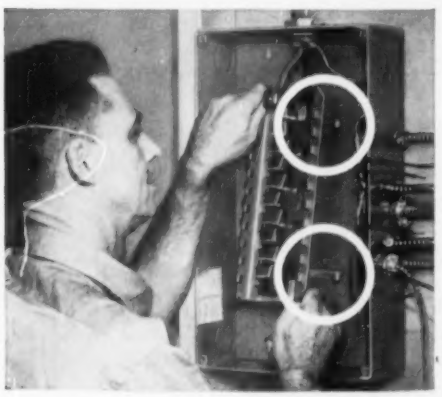
Save costly cable. Boxes and interior mount either-side-up to meet line wire positions.

Avoid skinned knuckles. Interior "snaps" in and out in seconds, giving plenty of room to swing a hammer or pull wires—inside the box.

Mount box fronts fast. Fronts hook on like a picture, lock with just two captive screws.

Enjoy automatic front alignment. Spring-mounted, snap-out interior "gives" with pressure, levels breakers automatically—even when box is off plumb.

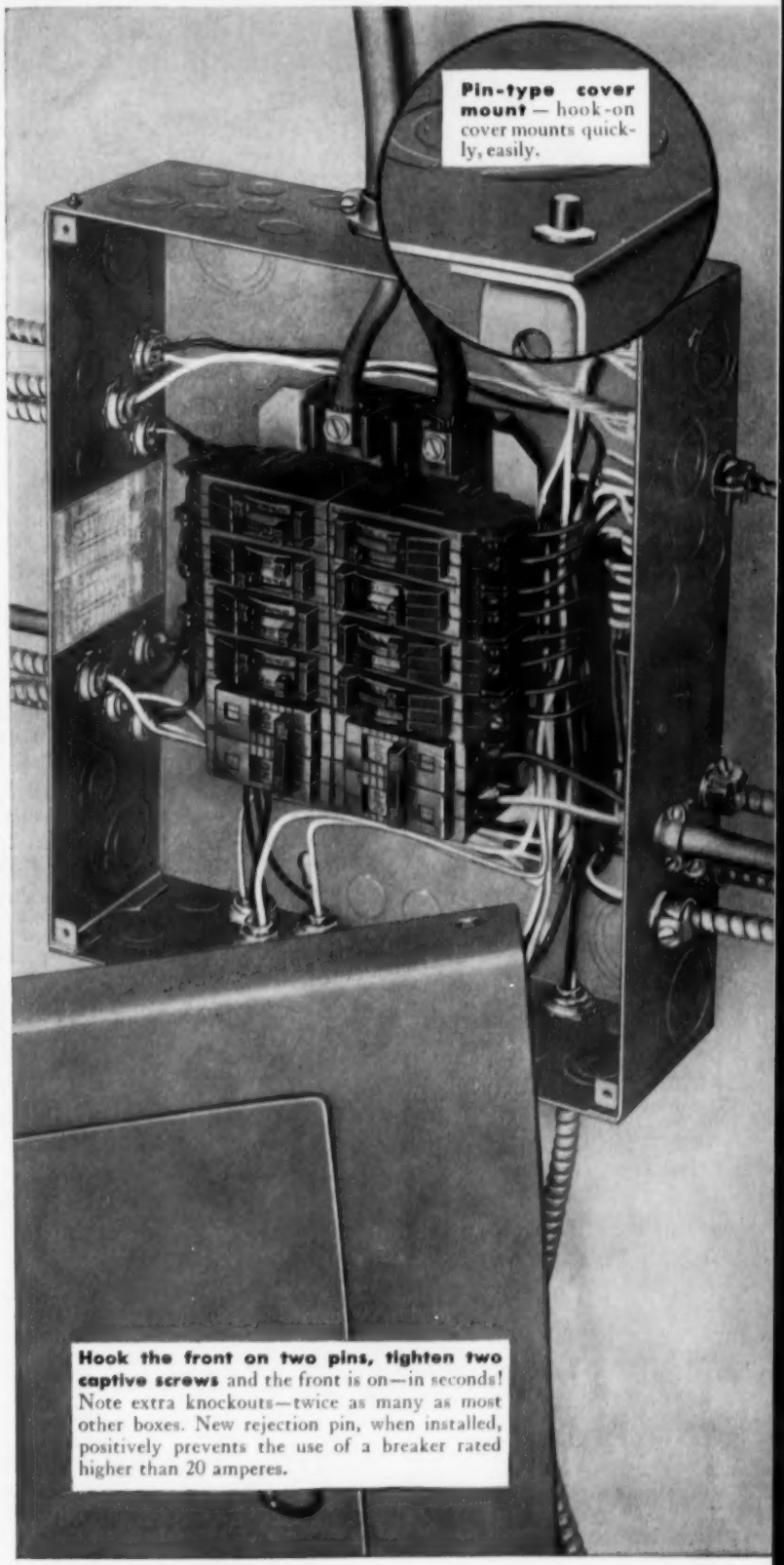
These contractor shortcuts will save you 20 per cent in job time, as proved by actual contractor tests.



Interior "snaps" in and out in seconds for full wiring room. Interior mounts on springs, "gives" with pressure, automatically lines up breakers with front even when box is off plumb.

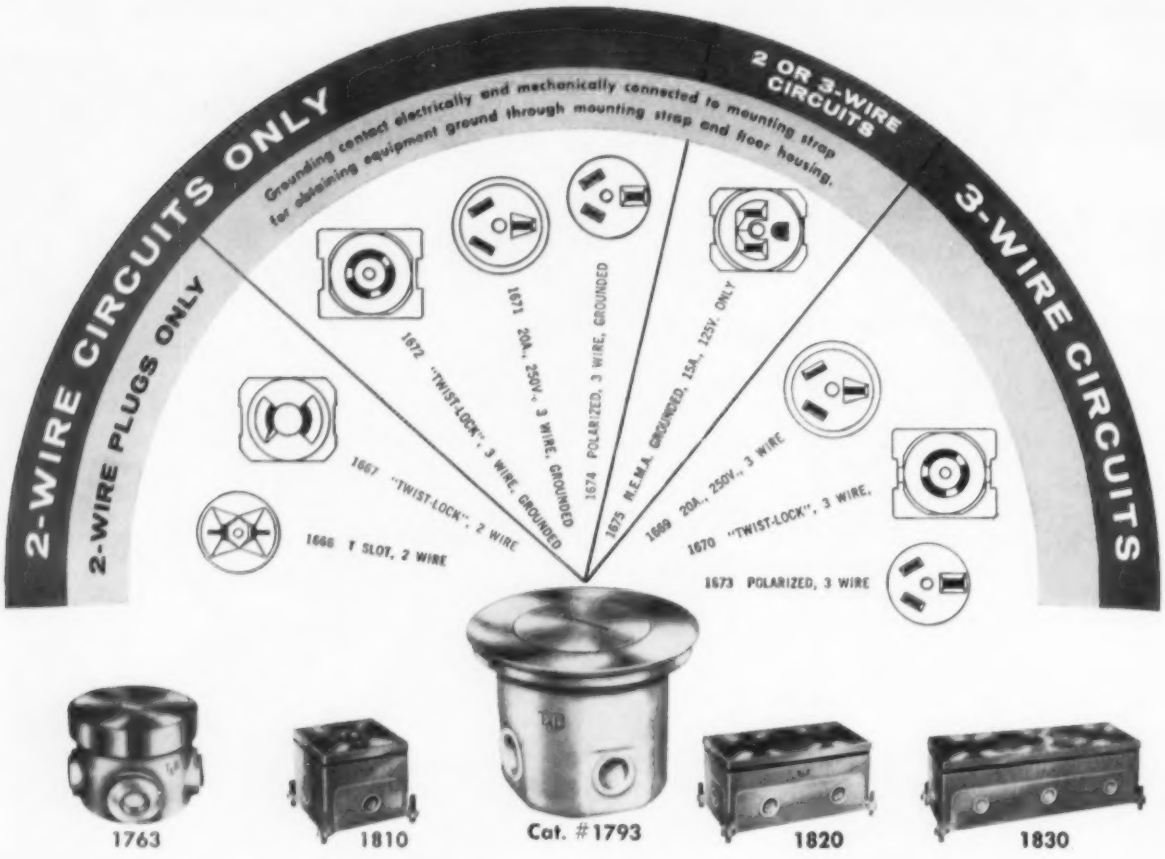
From 40 to 200 amperes, from 2 to 40 circuits G-E's 45 new load centers will cover every job. Have your G-E distributor show you the new load centers and the "twin" breaker. See for yourself how to get more quality circuit breakers into a smaller load center, in more circuit combinations, at the lowest cost. *General Electric Company, Circuit Protective Devices Department, Plainville, Conn.*

LIVE BETTER ELECTRICALLY



Pin-type cover mount — hook-on cover mounts quickly, easily.

Hook the front on two pins, tighten two captive screws and the front is on—in seconds! Note extra knockouts—twice as many as most other boxes. New rejection pin, when installed, positively prevents the use of a breaker rated higher than 20 amperes.


2-WIRE CIRCUITS ONLY
2-WIRE PLUGS ONLY
2 OR 3-WIRE CIRCUITS
3-WIRE CIRCUITS
Grounding contact electrically and mechanically connected to mounting strap for obtaining equipment ground through mounting strap and floor housing.
1666 T SLOT, 2 WIRE
1667 "TWIST-LOCK", 2 WIRE
1672 "TWIST-LOCK", 3 WIRE, GROUNDED
1671 20A., 250V., 3 WIRE, GROUNDED
1674 POLARIZED, 3 WIRE, GROUNDED
1675 N.E.M.A. GROUNDED, 15A., 125V. ONLY
1669 20A., 250V., 3 WIRE
1670 "TWIST-LOCK", 3 WIRE,
1673 POLARIZED, 3 WIRE
1763
1810
Cat. #1793
1820
1830

New! T&B floor box receptacle

MATCHES YOUR CIRCUIT WIRING AND THE PLUG ON YOUR EQUIPMENT

Here's a convenient money saver from T&B . . . designed to make the use of many types of receptacles easier and more readily available. T&B receptacles (there's one for every need) fit all T&B floor boxes . . . and they can be changed in a matter of minutes should you later install equipment which requires a change in receptacles.

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No. 4403-PB single circuit, 660 watt, 250 volt socket with ⅜" cap and shade threads. Double thick impact resisting cap and casing of molded phenolic screws together for easy wiring and assembly. Molded lever and push button adaptation of LEVOLIER switch mechanism. Perfectly insulated with no exposed metal.

The toughest industrial sockets made—

McGill LEVOLIER phenolic and brass sockets have the quality needed to withstand the hard use and abuse of industrial service. Important to you is the saving these sockets offer by eliminating frequent replacement of ordinary sockets.

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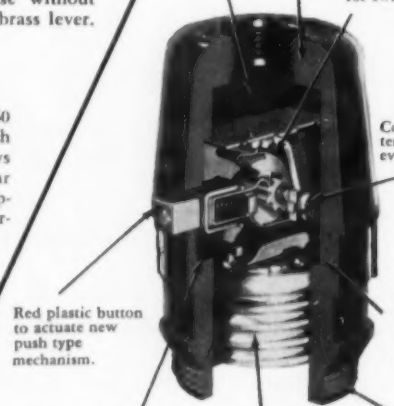
No. 4403-FL single circuit, 660 watt, 250 volt socket. LEVOLIER switch mechanism with molded lever control. ⅜" cap, shade threads. This and 4403-PB especially adaptable to machine lighting.

No. 4303-PL single circuit, 660 watt, 250 volt socket. Molded phenolic case with ⅜" cap. Molded phenolic case without shade threads. Plain brass lever.

No. 4100 single circuit, 660 watt, 250 volt brass socket with ⅛" cap and casing that screws together with a locking collar and prevents accidentally snapping the sections apart. Universal pull lever and chain.

No. 4120-PB two circuit, 250 watt, 250 volt for two filament bulbs. Sequence of operation is High, Medium, Low and Off. ⅛" cap. Push button control. Available in molded phenolic also.


Ample space above mechanism permits tieing Underwriters' knot.
Extra heavy shell of impact resisting molded phenolic
Special alloy of high conductivity bronze for switch contacts.
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Red plastic button to actuate new push type mechanism.
Upper and lower halves screw together for easy assembly.
Mechanism rigidly supported in shell.
Lamp base screw shell .006" heavier than standard.
Shell completely insulated with no exposed metal.
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IN CANADA: VERD-A-RAY ELECTRIC PRODUCTS LTD MONTREAL 9,

Now you can operate <u>two</u> H-1 400-watt outdoor mercury vapor lamps from a <u>single</u> Sola Constant Wattage Ballast

Operating advantages embodied in the Sola Constant Wattage Mercury Vapor Lamp Transformer have proved so desirable and practical that this type of ballast is fast becoming the generally-accepted standard for mercury vapor lighting installations. Now constant wattage operation plus the economy of two-lamp ballasting is available in a single Sola CW Mercury Vapor Lamp Transformer.

This new design is specifically for two-lamp, outdoor service in commercial and industrial applications of H-1 400-watt mercury vapor lamps. Its famous Constant Wattage Principle of operation offers users the following performance features:

- *Low starting current surge*
- *Regulated lamp wattage and light output*
- *Open circuit protection*
- *Elimination of need for primary taps*
- *No extinguishing on line voltage dips*
- *Extended lamp life*

For additional information on your particular application, contact your sales engineer listed below. He's one of a nationwide organization maintained by Sola Electric Co. to provide you with prompt service.

SOLA *Mercury Vapor Lamp* **TRANSFORMERS**

Write for Bulletin 17H-MV-244
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This Sylvania Fixture casts a bright new light on scientific research ... for this large industrial manufacturer

Upward light component on Sylvania NTWS fixtures means more and better light on the job. Reflector slots also induce lamp-cleaning upward "chimney" draft.

For over half a year, Sylvania NTWS industrial lighting fixtures have been on the job at the new physics research laboratories of one of the country's largest industrial firms.

These semi-direct lighting units maintain the high 70-80 footcandle levels needed for critical seeing tasks, in studying the electrons which surround the atomic nucleus, in developing a long list of new products based on these studies.

Spearheading new trends in industrial lighting, Sylvania NTWS fixtures deliver a full 10% upward light component through slots in reflectors. This increases illumination efficiency and total light output. *It mellows harsh overhead contrasts ... softens eye-straining shadow and glare spots at working level.*

"The Sylvania fixtures were selected because they met specifications set forth by our General Engineering Department, at a realistic price," reports an engineering representative from these laboratories. "In 8 months of use, there has been no drop in efficiency, no repairs have been required, and lamp replacement is rapid and easy."

For expert lighting assistance, contact the Sylvania Fixture Specialist in your area. And write direct for our *free* new helpful booklet No. V-501, "*Prescribed Lighting Protects the Eyes of Industry.*"

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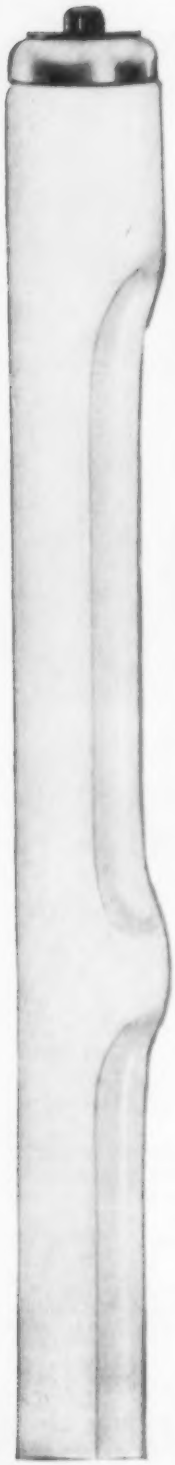
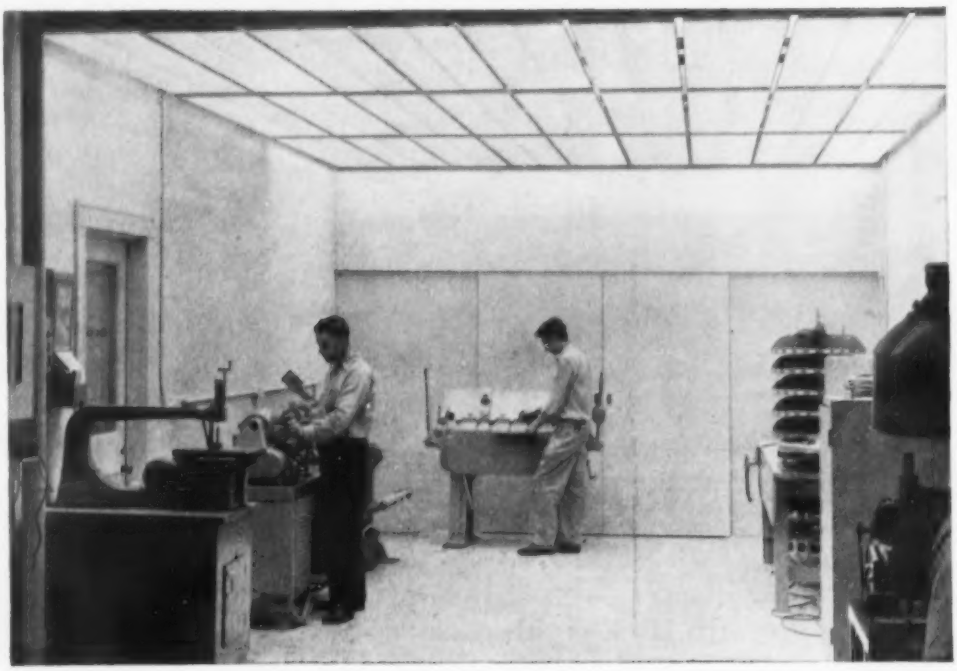
Specify G-E "Power-Groove" Lamps to give your customers a higher, more economical lighting level



Actual installations of General Electric's new "Power-Groove" Lamps are proving the advantages demonstrated in "World's Brightest Workshop"



TODAY, at General Electric's Lighting Institute in Nela Park, the workshop shown above uses new G-E "Power-Groove" Lamps to produce a lighting level *more than double that of any other known industrial installation!* It's an actual work area, demonstrating that "Power-Grooves" are ideal for use in most industrial areas, behind louvered ceilings in stores and offices, and for street lighting, signs and other outdoor applications.

G-E "POWER-GROOVE" LAMPS SAVE INVESTMENT DOLLARS. Because your customers get almost twice as much light per tube as High-Output fluorescents . . . 2½ times as much as 8-foot slimlines . . . you can now give them more light per fixture. Besides having fewer parts to maintain, there is a 5-20% savings on initial investment compared to other fluorescent lighting systems.

GET THE WHOLE EXCITING "POWER-GROOVE" STORY! Write to General Electric Co., Large Lamp Dept. EC-87, Nela Park, Cleveland 12, Ohio. Or visit this workshop yourself for an on-the-spot demonstration of how G-E "Power-Grooves" can work for *your* customers.

Progress Is Our Most Important Product

GENERAL ELECTRIC

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ADVANCE TRANSFORMER COMPANY has appointed over 600 Service-Stocking Distributors throughout the United States who are participating in this nation-wide program. These authorized distributors carry a complete stock of all popular ADVANCE ballasts to give immediate replacement service for any make fluorescent lamp ballast whenever replacement is necessary. Simply bring the inoperative ballast to any ADVANCE Service-Stocking Distributor. The ADVANCE cross-reference guide shows at a glance the replacement needed, and in a few moments, you can be back on the job with the correct ballast.

All ADVANCE fluorescent lamp ballasts carry a two-year warranty and are replaced without charge. The ADVANCE label is your assurance of dependable, efficient performance at lowest cost . . . the result of years of research, engineering and development.

The ADVANCE Service-Stocking Distributor Program enables you to give better service and greater customer satisfaction.

The plan works equally well for all ballast users . . . if you are not now utilizing the ADVANCE Service-Stocking Distributors' Program, write today for complete details.

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In all Standard Enclosures

A nationwide network of Authorized Cutler-Hammer Distributors offers prompt supply of Cutler-Hammer Three-Star Motor Control in all generally used sizes, constructions and enclosures. Also all needed control accessories and matching safety switches.

In Special Construction

Machinery builders have been quick to recognize the many advantages offered by Cutler-Hammer Three-Star Motor Control components, including the spectacular new heavy-duty oil-tight pushbuttons.

In the Finest Control Center

The new Cutler-Hammer Three-Star Unitrol provides for the quickest installation or rearrangement of the finest in motor control equipment, cost-saving Cutler-Hammer Three-Star Motor Control.

All motor control is built to high standards; functional importance requires it. But the comparison of several makes in *actual use* proves there can be wide differences!

One make of control, for example, is much easier to install, so *much* faster that the man-hours saved in installing it often more than pay the entire cost of this control . . . Cutler-Hammer Three-Star Motor Control! Comparison in use also proves this control works better, makes electric motors work harder, avoids costly work interruptions. Cutler-Hammer Three-Star Motor Control in industry's "killer" jobs has shown a trouble-free operating life *several times* that of whatever control equipment it replaced.

Discover why this is industry's preferred motor control. Compare it in *use* and see why you should also specify it as your standard. , , , CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto.

The Panel Builder's Handbook, a comprehensive data book on Cutler-Hammer Three-Star Motor Control components and accessories is offered free of charge to machine design and control panel engineers. Write today on your company letterhead for Pub. EE-120.

CUTLER-HAMMER
MOTOR CONTROL
C-H

ELECTRICAL CONSTRUCTION AND MAINTENANCE

56th Year — AUGUST • 1957

Keeping Ahead of Plant Loads

Industrial plant electrical systems are exposed to all of the growing pains of advancing electrical utilization that affect systems in other types of buildings. The onset of electrical inadequacy in the plant, however, is likely to be a build-up of many relatively small changes rather than the large load increments, like relighting or air conditioning, that trigger commercial building electrical modernization requirements.

Motor, machine or process changes are such commonplace, every-day events, and made, as is usually the case, under such rigorous time schedules that cumulative load effects on the system are often overlooked or, at best, noted for study at some more convenient future time.

The problem is further aggravated by the not uncommon notion in management that the basic electrical system is a fixed utility, like a heating plant, inherently adaptable to any requirements of the space served. Such notions, unfortunately, can have practical effects. While new equipment branch wiring and connections are readily authorized as routine necessities, the need for essential increased supporting capacity in the supply system is usually a lot more difficult to sell to the front office.

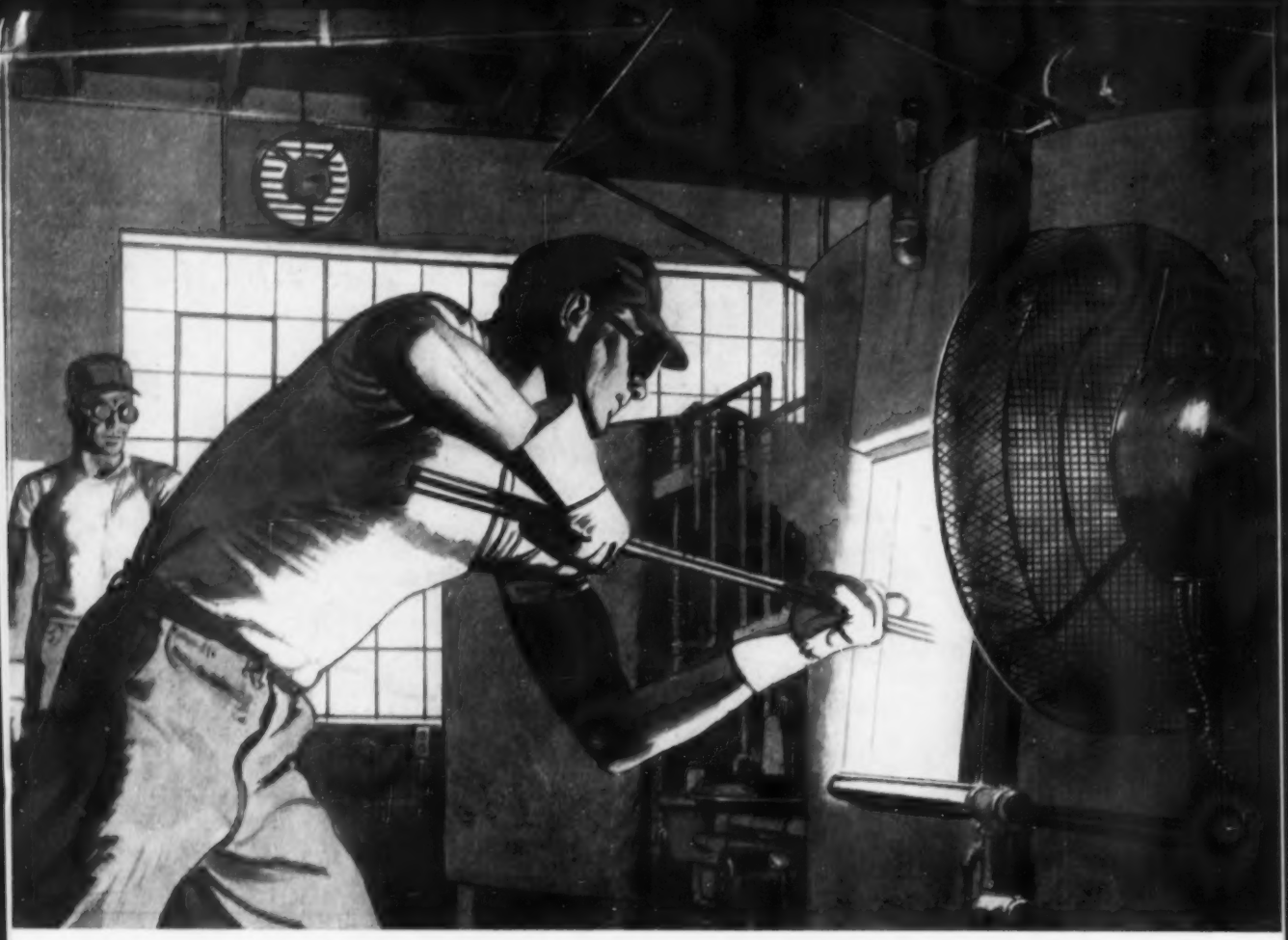
To keep the electrical system safely ahead of load requirements takes a deliberate program which must include, 1) an easy-to-administer routine which will insure that all load changes are promptly recorded and effects on the system noted and, 2) clear criteria for initiating system alterations well in advance of overload conditions.

The keynote of recording routines should be simplicity. The first requirement is a record of each load change as it occurs—information usually available from routine work orders. These data should be then transferred promptly to the load summary of the feeders and apparatus affected. Posting directly on a wall mounted diagram of the system is particularly effective since it provides a conspicuous visual display readily accessible to all responsible personnel.

At what point loading should initiate corrective measures will vary with the growth rate and potential needs of the particular plant or system. Typically, nameplate loads over 65% of rated capacity of any part of the system should command attention, and corrective action should become mandatory at not over 80%. But whatever values are selected, they should be firmly adhered to and decisive enough to support prompt management authorization for the work.

A few easy-to-administer routines and some plain rules to guide decisions on system improvements can keep the electrical department well ahead of load requirements. And giving the system the regular attention and importance it deserves will provide solid facts to enlist the confidence and cooperation of top management when major improvements are required.

Wm. T. Stuart



Help your customers to clear profits from fresh air. Graybar will be glad to work with you and your customers in planning a ventilating system using standard ILG units that will cut worker fatigue, reduce costly accidents and material spoilage and speed production all around. Graybar maintains a network of offices and warehouses from coast-to-coast. Call the Graybar location nearest you at the first opportuniy.

VENTILATION

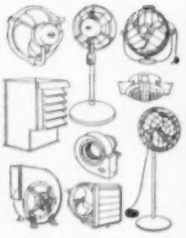
. . . your customers' key to lower costs

Fumes, dust, heat and foul air lower working efficiency and increase your customers' plant operating costs.

Whether the situation calls for portable fans for spot cooling or self-cooled propeller fans and universal blowers for large-volume circulation, ILG fans and blowers, available from Graybar nationally, are the best-built units you can provide. Call your nearest Graybar office for free survey help on any ventilation job. We'll be glad to help you in the selection of the ILG equipment best suited for individual requirements and to furnish accurate information to assist you in preparing bids and working out practical job time tables.

Remember, Graybar is your most dependable *single* source of everything electrical – over 100,000 electrical items for wiring, lighting, communication, power as well as ventilation.

620-48



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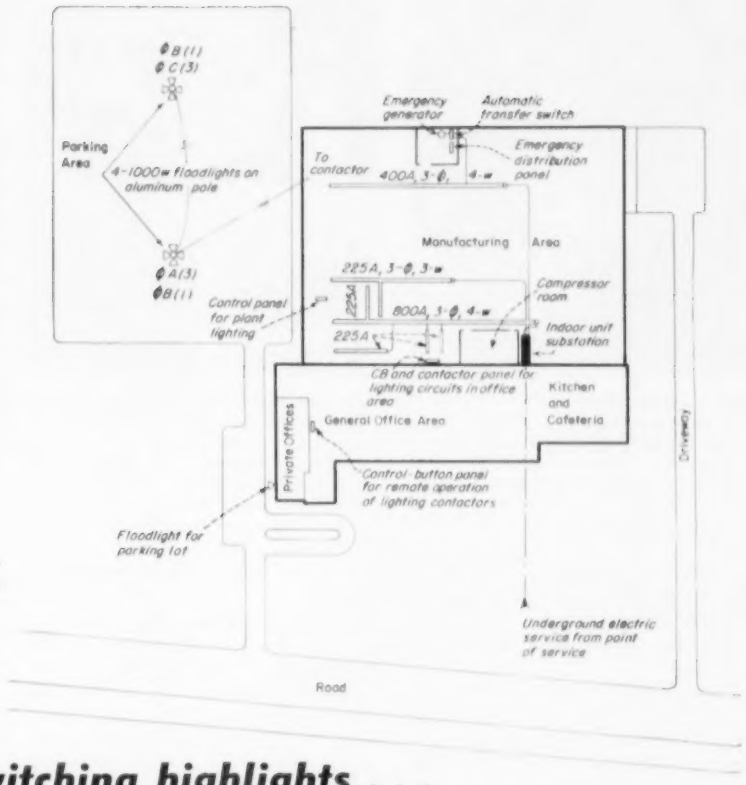


PLOT PLAN of plant shows layout of interior, with major busway distribution in manufacturing area.

Remote-control switching highlights . . .

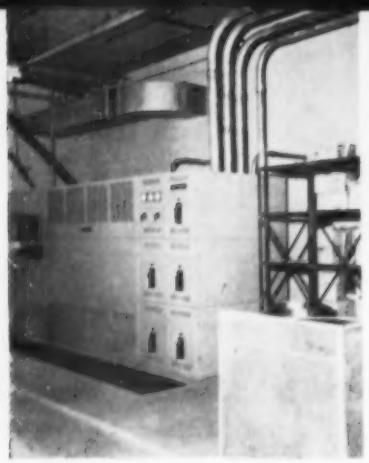
VERSATILE PLANT DISTRIBUTION

A modern 480/277-volt distribution system is an integral part of manufacturing operations at the new plant of Automatic Switch Company, with extensive remote-control switching of branch and feeder circuits and widespread application of plug-in busway supplying drop-cord branch circuits to motor loads. The electrical system was designed and installed by Lightning Electric Service, Newark, N. J.

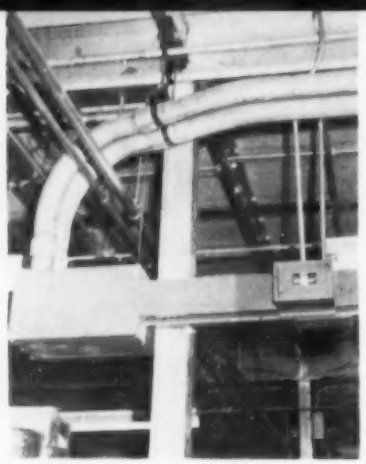
By Michael Zaleske,
Plant Engineer, Automatic Switch Co., Florham Park, N. J.

COMPLETE integration of electrical facilities in a large manufacturing operation is well represented in the new plant of Automatic Switch Company. Here, electrical distribution and circuiting to power and lighting loads are arranged to perfectly meet and mesh with operating requirements.

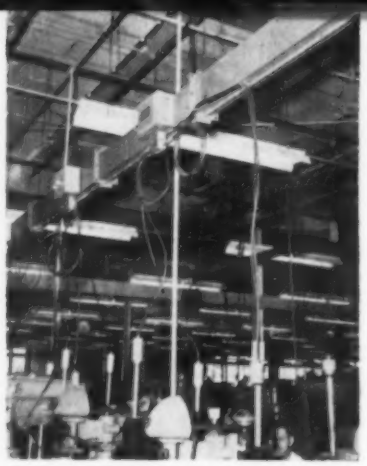
The overall system in this plant includes a range of modern techniques and methods. Basic distribution and utilization are made at 480/277 volts, 3-phase, 4-wire, wye connected. Plug-in busway runs provide high-capacity, reliable distribution to machine loads, offering almost unlimited flexibility of relocation to meet adjustments in layout of plant loads. Drop-cord connections to the many small machine motors provide ready disconnect and relocation of machines. And substantial spare capacity and provisions for expansion have been designed into the system to accommodate immediate and long-range



UNIT SUBSTATION, 1000-kva heart of plant electrical system, is compact assembly tucked away in central part of plant and supplied underground from utility pole line. Conduit feeders to busway are at right end.



800-AMP BUSWAY, largest distribution feeder, is fed by eight 500 MCM's arranged as multiple conductors per phase and divided between two conduit runs to cable tap box on end of busway adjacent to unit substation.



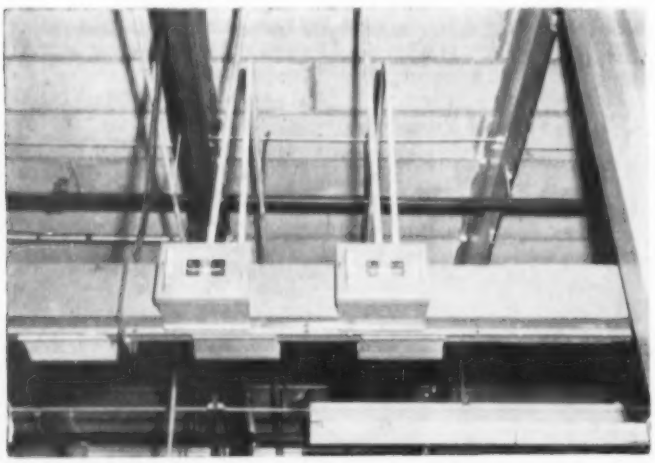
MOTOR BRANCH CIRCUITS consist of type S dropcords with locking 30-amp receptacles on ends to connect to matching plugs mounted on top of short conduit lengths rising from machine units. Junction box coupled to knockout on each bus tap switch enclosure provides convenient tapping of two, three or four motors to each switch. Each bus switch is fused to provide short circuit protection rated for the number and sizes of motors connected to the single branch circuit. Method of circuiting affords quick relocation of machines.

load growth in the plant. A detailed analysis of this installation reveals the significance of the wealth of design and construction highlights involved.

The plant building itself is a single-level structure in a rural area. It houses office areas and laboratory facilities in addition to the large area for manufacturing remote-control switches and automatic switch devices. In plan, the building is basically square, with the office areas across the front. Of course, the back part of the building, the manufacturing area, contains the major part of the total load. Design of the plant's electrical system was carefully related to the physical layout of the building and to the various load concentrations.

Electrical design and construction in this new plant was greatly influenced by the old plant from which the company moved to this new one. The old plant was a three-story building in an urban area. From years of study of operations in the old plant, company management had developed firm ideas on the type of plant and layout best suited to the specific manufacturing activity. The new plant is a realization of those ideas.

In the old plant, power and lighting loads operated on a number of utilization voltages—230 volts, single-phase and 3-phase; and 120/208 volts, 3-phase, 4-wire. Conduit and wire were used for risers to the floors where some busway and standard distribution panels provided circuiting to the loads. When the company decided on the move to the new plant, considerable study had to be given to the new electrical system which would be called upon to supply the many machines of varying voltage and to accommodate other control and distribution equipment from the old plant. Against this background, the present electrical system was designed. And the job of fitting equipment from the old plant into the new system is still going on.



BUS TAP SWITCHES shown here are fused at 20 amps, each tapping a 3-phase, 4-wire, 480/277-volt lighting circuit from the 800-amp busway run. From each switch, four No. 12's in ¾-in. conduit are carried up and over to a 30-amp 3-pole remote controlled switch mounted on a nearby column.

Distribution

Power for the entire building is brought in under the floor slab at 4160 volts, 3-phase, 3-wire, from an outside utility pole line. The incoming line comes up into a 1000-kva dry-type, indoor unit substation at the side of the manufacturing area. Provision has been made to permit ready installation of another 4160-volt service feeder to meet future load growth. The present incoming line terminates in a primary, fused load-break switch which provides service disconnect and overcurrent protection for the 1000-kva transformer.

The substation secondary is rated at 480/277 volts, 3-phase, 4-wire, wye. Thorough study of the

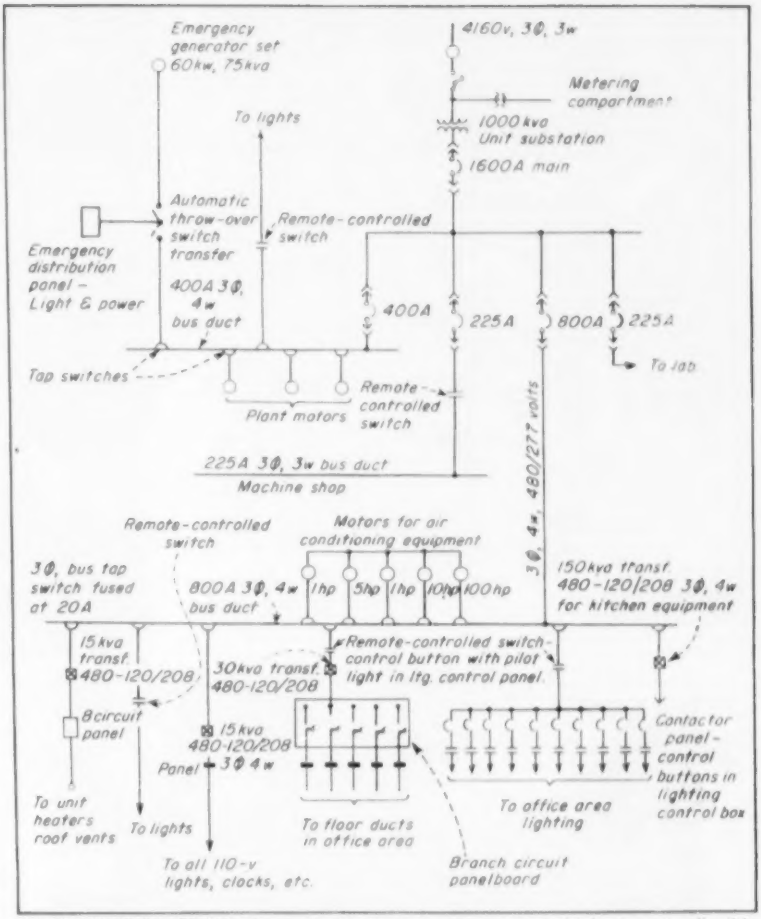
distribution voltage arrangement indicated that the use of 480/277 would provide substantial savings in the overall system. Because this voltage level was not available from the utility, the unit substation was used with a primary service. Distribution throughout the plant building originates from the substation secondary.

A 1600-amp main air circuit breaker is mounted ahead of the air circuit breakers used for disconnect and protection of main distribution feeders. This 1600-amp main ACB has extra taps on its load side to permit tapping the full output capacity of the substation for testing purposes during off-peak hours.

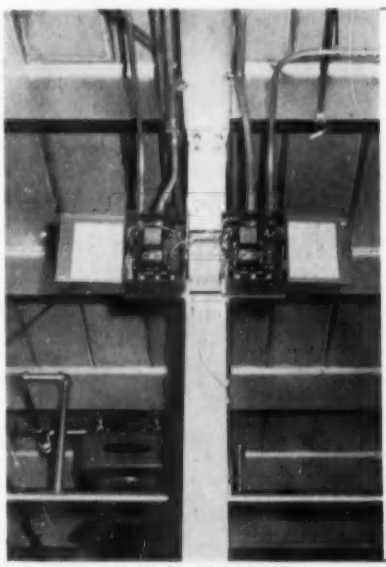
Power distribution throughout the plant is made by plug-in busway runs. Power and lighting are supplied from 3-phase, 4-wire busways as shown in accompanying diagrams. The machine shop equipment is powered from a 3-phase, 3-wire busway run. The 3-wire busway is rated at 225 amps and is fed through a 200-amp remote-control switch mounted on the roof steel. At night, the entire load served by this busway can be disconnected by a remote control button which actuates the switch.

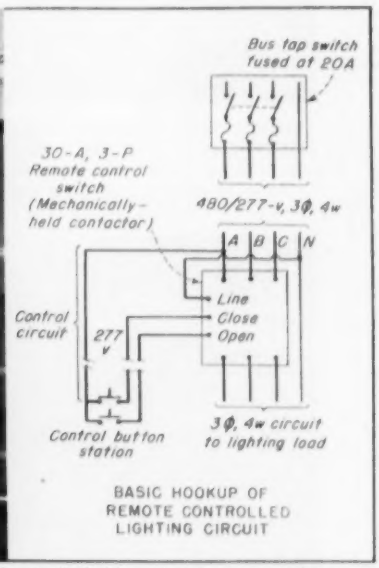
Power and lighting taps from the plug-in busway runs are made by fused tap switches. In the case of machines, No. 10 type S cords are used to bring 3-phase, 4-wire, 480/277 volts down from the tap switch. Almost all of the motors are fractional or small integral hp (under 2 hp) motors. A 3-phase, 4-wire, receptacle on the end of each drop cord provides ready connection to a corresponding plug mounted on top of a length of conduit which rises from each machine to a height of about 5 ft. The supply conductors in the conduit carry power to the small-hp motors in the machines. One phase of the supply to each machine is used for local lighting—either directly at 277 volts to a 275-volt incandescent lamp, or indirectly through a small 480/120 lighting transformer to a 120-volt incandescent lamp.

The plug and receptacle connection of motors provides disconnecting means for the individual motors which are equipped with individual starters. Running overload protection is provided in the starters. Branch circuit overcurrent protection—short circuit protection—and group disconnect are



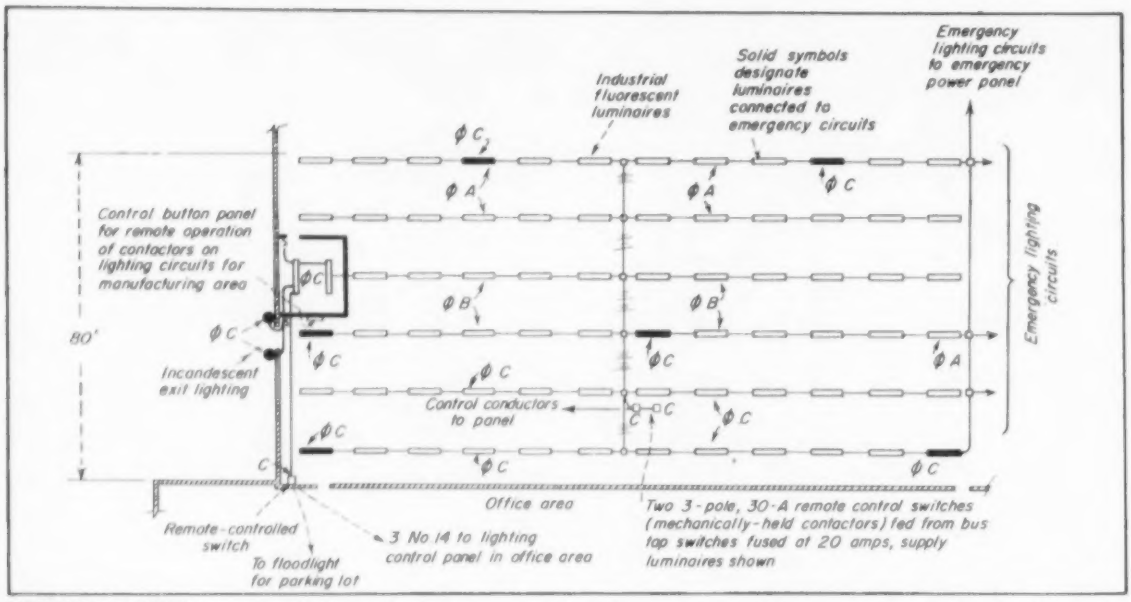
SINGLE-LINE DIAGRAM of overall distribution system reveals high capacity, flexible circuiting to power and lighting loads throughout the entire building.



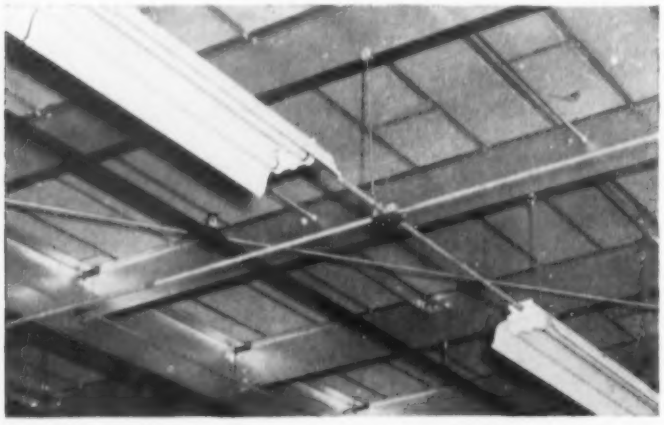


BASIC HOOKUP OF REMOTE CONTROLLED LIGHTING CIRCUIT

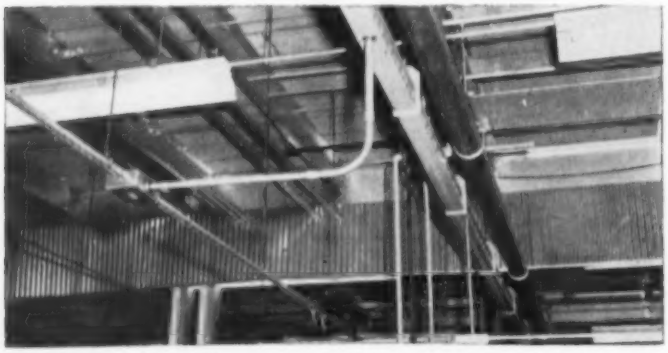
REMOTE CONTROL SWITCHES are mechanically-held contactors mounted in enclosures on a column in manufacturing area. Each unit is supplied by four No. 12's, switching the three 277-volt-to-neutral phase legs of each circuit to control a large block of 277-volt industrial luminaires. Control conductors for switch operation are carried in conduit to a control-button panel at one end of the manufacturing area.


Emergency lighting circuits to emergency power panel
Solid symbols designate luminaires connected to emergency circuits
Industrial fluorescent luminaires
Control button panel for remote operation of contactors on lighting circuits for manufacturing area
80'
Incandescent exit lighting
Control conductors to panel
Emergency lighting circuits
Office area
Remote-controlled switch
To floodlight for parking lot
3 No 14 to lighting control panel in office area
Two 3-pole, 30-A remote control switches (mechanically-held contactors) fed from bus tap switches fused at 20 amps, supply luminaires shown

LIGHTING LAYOUT for one-sixth of manufacturing area of plant shows circuiting of luminaires connected on two 20-amp circuits controlled by remote control switches and circuiting of emergency lighting units.



LIGHTING SYSTEM in manufacturing area consists of industrial luminaires suspended on rod hangers from clamps on roof beam flanges. An interconnecting gridwork of conduit and junction boxes supplying the fixtures as shown here is also rod-suspended from the roof beams.



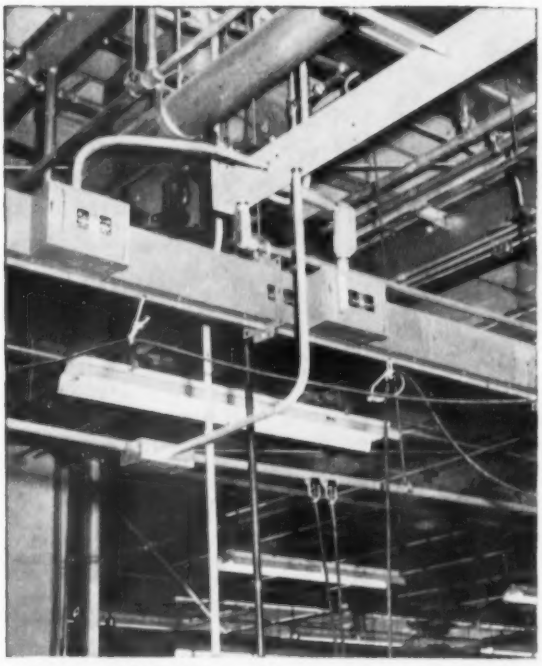
SUSPENDED WIREWAY is widely used in the plant to provide distribution and interconnection between busway runs and other system sections. Here a conduit feed out of the wireway shown connects to a junction box at left to supply a run of 277-volt, 30-amp trolley busway.

provided in the busway tap switch. The hookup of motors follows design procedures for more than one motor on a single branch circuit, as shown in an accompanying photo.

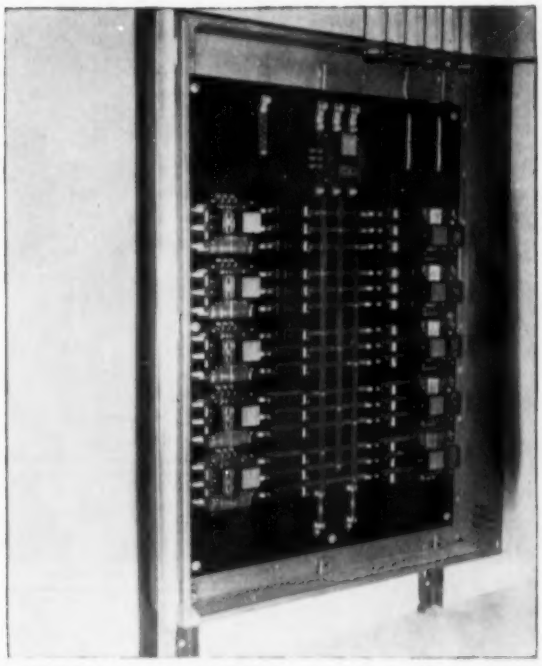
Lighting

General lighting in both the manufacturing and office areas is provided by rapid-start fluorescent luminaires connected on 277-volt, phase-to-neutral, circuits. Lighting circuits are protected at 20 amps and are controlled by remote control switches. Lighting in the office area is fed from a lighting panelboard in the manufacturing area, on the wall separating the two areas. The remote control switches are mounted in the panel but are operated from buttons in a control panel at one end of the office area. Luminaires in this area are louvered commercial units suspended 1-ft from the ceiling, producing a comfortable, well-diffused lighting intensity of 60 ft-c.

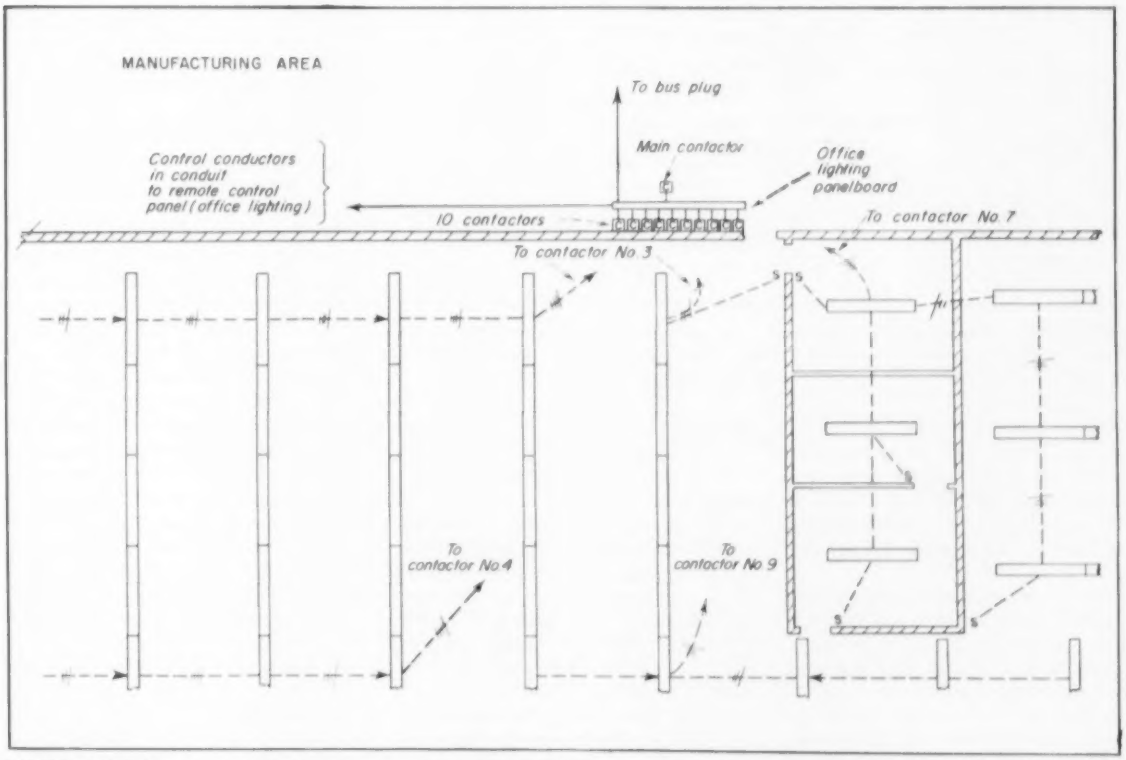
In the manufacturing area, lighting circuits are tapped from busway and controlled by column-mounted remote control switches operated from a wall-mounted control panel. The luminaires in this area are 2-lamp, slotted top industrial fluorescent units which provide a 20% uplighting component to reduce harsh contrast between the brightness of the lamps and the ceiling area above the units. Lumi-



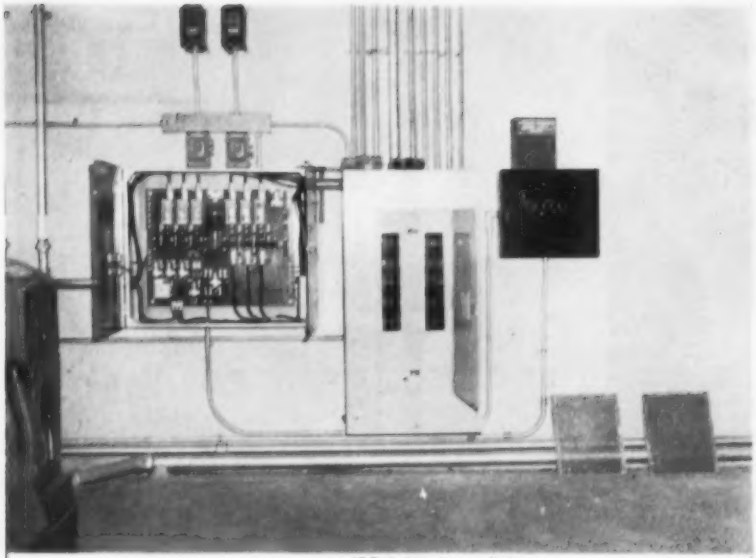
SUBFEED CONNECTIONS are here made on 400-amp busway in rear section of manufacturing area. Tap switches are fused to protect 480-volt power subfeeders and 277-volt lighting and appliance subfeeders. Busway is tapped to supply wireway for loads between busway runs. Wireway is also shown tapped to JB in trolley bus run.

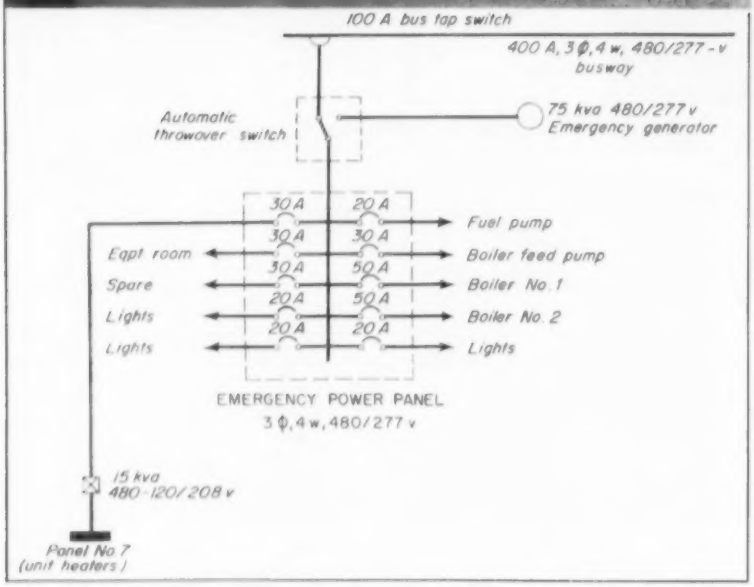


CONTACTOR PANELBOARD on wall in manufacturing area is fed through main contactor from bus tap switch and provides circuit breaker protection and remote switch control of lighting branch circuits to continuous-row fluorescent luminaires in adjoining general office area. Remote switches for branches are 3-pole 30-amp units.

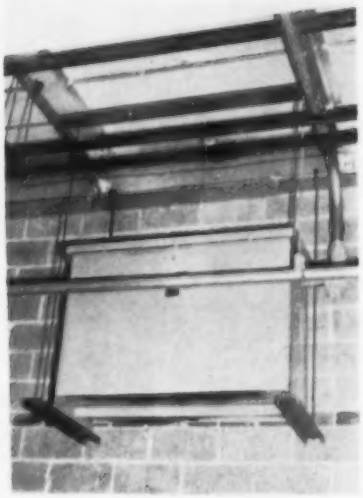


OFFICE LIGHTING is circuited from the remote control panelboard as shown in this section of general area layout, with branch circuits controlled by remote control switches. Each contactor is operated by a button in the control panel at the end of the office area. A master button there provides control of the main contactor in the main bus to the panelboard.





AUTOMATIC TRANSFER from normal to emergency supply for the emergency distribution panel at center is made by transfer switch at left which starts emergency generator and connects it to emergency panel if normal supply should fail.



150 KVA TRANSFORMER for kitchen equipment in cafeteria area is supplied from bus tap switch, connected 480-to-120/208, 3-phase, 4-wire and mounted on rod-suspended channel strips in the manufacturing area—near the ceiling and against a wall adjacent to the kitchen area.

naires are mounted on 14-ft centers, suspended from rods at a height of 13 ft above the floor. Lamps used are rated at 100 watts, 800 milliamps. The average lighting level in the manufacturing area is 40 ft-c.

In the general office area an underfloor duct system carries telephone and receptacle circuits separately to many outlets in the area. For convenience receptacle outlets, 120-volt circuits in the ducts are supplied from five small lighting panels through a 30-kva transformer. Master control of the complete 120-volt underfloor system is provided by a remote control switch in the supply to the 30-kva transformer, operated by a button at the office control panel.

To handle emergency requirements for power and light, a 60-kw diesel engine generator is installed in a mechanical room at the rear of the plant. This unit has a 480/277-volt, 3-phase, 4-wire output, with capacity sufficient for essential heating and emergency lighting and power facilities. An automatic throwover switch provides starting of the emergency generator and connection to emergency circuits.

As shown in an accompanying diagram, the emergency distribution panel is normally supplied from the 400-amp busway in the rear of the manufacturing area, through the automatic transfer switch. Upon failure of the normal supply system, the emergency generator feeds the emergency panelboard through the transfer switch to energize the strategically spaced emergency luminaires throughout the manufacturing and office areas. These luminaires are installed as part of the overall general lighting layout, but are circuited from the emergency panel. They operate when the normal or emergency supply is in service.

Throughout this plant, the use of remote control switches for feeders and branch circuits greatly simplifies load control. From a minimum of convenient control points, fast and reliable ON-OFF control can be exercised over large blocks of lighting or power loads. This is particularly effective for disconnecting all loads at the end of the day, without need of operating the local control device for each piece of utilization equipment.

A roundup of installation and design details are shown in accompanying illustrations. At present continuing electrical wiring of various sections of the plant is being done by Mayer Electric Service, electrical contractors of Elizabeth.

Operating Costs—Direct Job Expense and Overhead

By **Ray Ashley,** *Research and Consulting Engineer, Oak Park, Ill.*

QUESTION:

What are the top major divisions of operating costs?

ANSWER:

Direct job costs (or direct job expense) and overhead comprise the two operating cost categories.

A PARTIAL LIST OF OPERATING COSTS

DIRECT JOB EXPENSE ITEMS	OVERHEAD EXPENSE ITEMS
Insurances	Administrative salaries
Tools—consumed and depreciated	General office salaries
Cartage	Rent
Engineering	Heat
Drafting	Light
Inspection	Telephone
Association dues	Office equipment
Interest on payroll	Stationery and supplies
Field office and shop	Postage
Prorata charges—the job.	Taxes and legal expense
Travel expense—to the job.	Advertising
Blueprinting	Research and time studies
Estimating	

FIG. 1—Division of operating costs showing partial listing of items that should be charged to direct job expense and overhead. Maintain such a list to facilitate accurate estimating and cost accounting.

DISCUSSION:

DIRECT JOB COSTS. Any item of expense that can be identified with a particular project is a direct job cost and should be charged against the project as such.

Insurances, engineering, and cartage are quite easily established as direct job costs. Tool costs are not always so easily identified. However, we know that a charge should be made directly to the job for such items. Fortunately, research has provided us with representative figures to be used for tool charges.

Figures are also supplied for charging off estimating costs as a direct job expense. This too, is an important item. The regular customer who lets contracts without requiring estimates, must not be penalized for the cost of estimating highly competitive work.

OVERHEAD. Items of expense which cannot be identified with any particular project constitute overhead costs. Executive salaries, salaries of the general office force, cost of heat, light, rent, and telephone belong in this group.

To establish a representative division of operating costs, a partial list of items chargeable to "direct job" and "overhead" expense are shown in Fig. 1. This listing classifies many operating costs common to electrical construction work.

ONE-MAN BUSINESS

APPROXIMATE DIVISION OF PROPRIETOR'S TIME

(Shown as a percentage of his total time)

ACTIVITY	OVERHEAD	DIRECT JOB COSTS
Administrative work	20.	—
Estimating	5.	20.
Engineering and layout	—	10.
Superintending		15.
Selling and making contacts	12.	3.
Purchasing	—	5.
Billing and collecting	5.	—
Miscellaneous	5.	—
Totals	47.0%	53.0%

FIG. 2—Allocation of a proprietor's time in a one-man business might approximate the division above. There is no specific formula. Experience and type of operation will establish proper apportionment between the direct job expense and overhead categories.

In the case of a one-man business, some of these costs must be prorated. In general, the proprietor manages the business, does the estimating, and engineers and superintends the work. Only a portion of his time is spent on executive duties and general work which is chargeable to overhead. Time spent in estimating, engineering, and supervising work must be charged off as direct job costs.

An approximate division of a one-man business proprietor's time is indicated in Fig. 2. On the basis of this analysis, 47 percent of his time is properly charged to overhead and 53 percent to direct job expense.

The reasons for keeping these two expense items separate will be discussed in another of this series of articles.

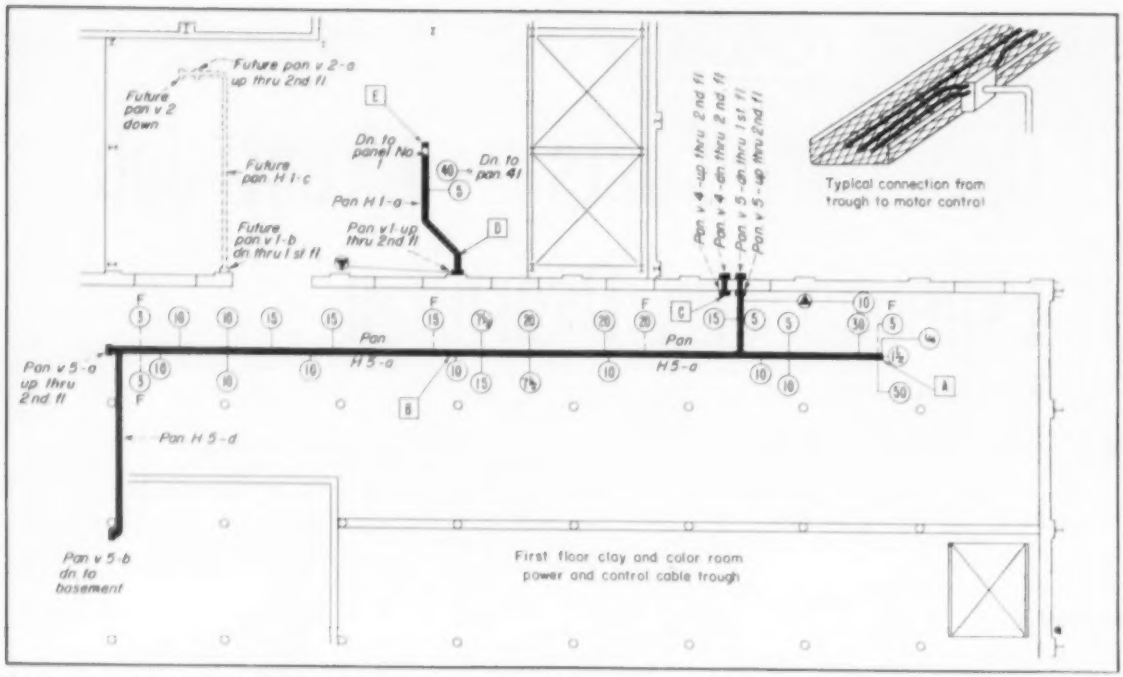
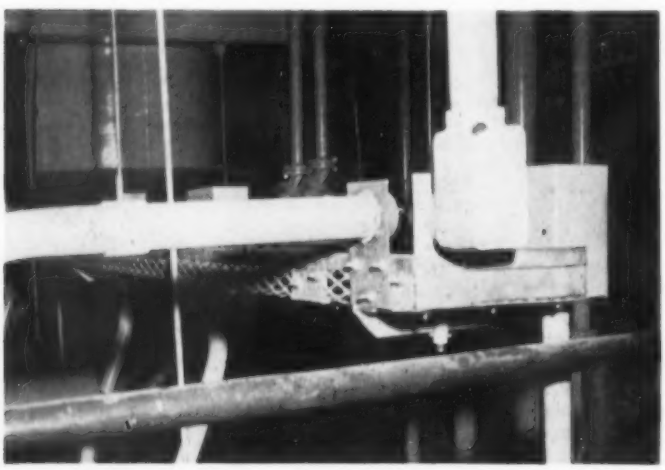

Future pan v 2-a up thru 2nd fl
Future pan v 2 down
Future pan H 1-c
Future pan v 1-b dn thru 1st fl
Dn. to panel No.
Dn. to pan 41
Pan H 1-a
Pan v 1-up thru 2nd fl
Pan v 4-up thru 2nd fl
Pan v 4-dn thru 2nd fl
Pan v 5-dn thru 1st fl
Pan v 5-up thru 2nd fl
Typical connection from trough to motor control
Pan H 5-a
Pan H 5-a
Pan v 5-a up thru 2nd fl
Pan H 5-d
Pan v 5-b dn to basement
First floor clay and color room power and control cable trough

FIG. 1—Plan view of trough installation in a section of clay and color room to carry circuit and control cables to approximately 30 motors along 100-ft length. Letters (A, B, etc.) with arrows point out typical trough sections illustrated in photographs.

CABLE TROUGH DISTRIBUTION

. . . . provides a flexible and economical solution to multi-motor service in humid conditions at S. D. Warren Company Central Mill Muskegon. System, installed by Whittaker Electric Co., facilitates circuit extensions.

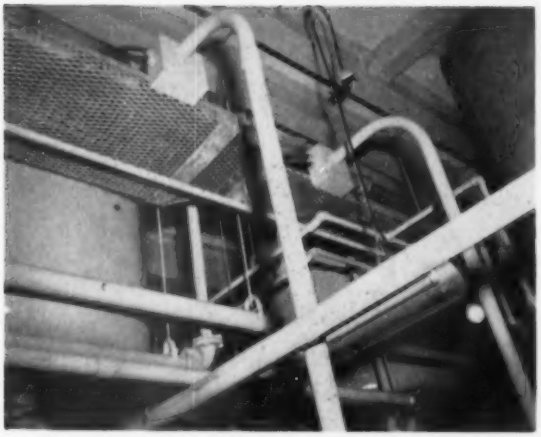
By Osborne B. Smith, *Chief Electrical Engineer, Engineering Division, Summer Sollitt Company, Chicago, Ill.*



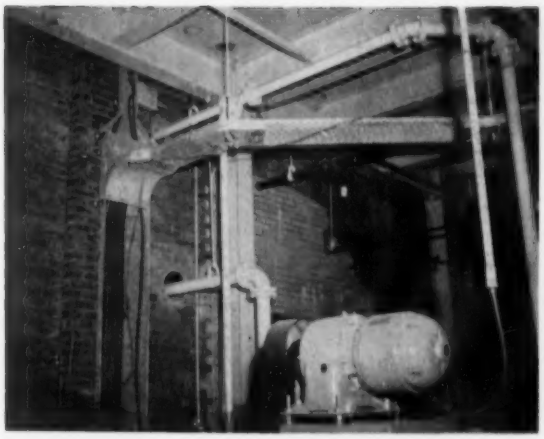
THREE TAKEOFF methods at end of trough employ: (L to R) bushed conduit on plate support; LB fitting on plate support; and cable splice box fastened to side of trough. Conduits carry circuit and control conductors to motor locations below.

A CABLE trough system of distribution featured electrical facility expansion at the S. D. Warren Company, Central Mill in Muskegon, Mich. Plant expansion and the installation of new coating machines and super calenders to improve product quality required the addition of some 6,000 kva to the plant electrical capacity. All of this supplementary purchased power is distributed through a total of six 1,000-kva, 3-phase, 4160/480/277-volt transformers with secondary switchgear spotted at load centers throughout the plant.

In general, primary feeders to the transformers are 3-conductor, 500 MCM, 5-kv, interlocked armor cable on aluminum ladder racks mounted to the building exterior walls or supported on roof trestles. Secondary feeders from adjacent



MAIN TROUGH line runs between rows of tanks and hoppers to feed pump motors on floor below. Multi-conductor, Neoprene-jacketed cables enter and leave screw-cover junction boxes on trough side for motor takeoff.

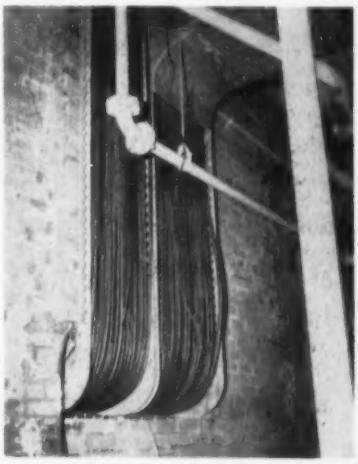


SPUR LINE of trough with double offset carries control cables from riser pan to group of pushbutton and pilot-light controls mounted on an adjacent column. Practically every motor has two points of control; remote and at the motor.

switchgear to distribution panels within the plant consist of similar 3-conductor, 500 MCM, interlocked armor cable on ladder racks.

It was at the 480-volt, power branch-circuit level that Summer Sollitt Company engineers faced these problems:

1. Routing of circuits through areas congested by rows of tanks, hoppers, process piping, conveyors, etc.
2. Dual control of individual motors from a remote control station and at the motor location.
3. Extremely humid operating conditions. Plant maintenance records indicated substantial replacement of rust-corroded conduit raceways in the past.
4. System flexibility. Secondary distribution had to be designed so future motor and control circuits could be added with comparative ease and economy.
5. Economy of initial installation and future maintenance of the distribution system.



DUAL RISER TROUGHS carry circuit and control cables down and through brick wall. Long vertical runs have cable-supporting riser elbow at top. Note vertical tee connection to horizontal pan at right. Expanded-metal cover is added to riser troughs.

DROP-OUT and trough extension from control spur encloses conductors terminating at group of pushbutton stations mounted on the column. Short section of wireway guides cables from trough to control enclosures, holds identification plates on hinged cover.

Troughs Solve Problems

These problems formed the basis of a searching inquiry into various electrical distribution methods. Sollitt engineers made a number of comparative cost studies and came up with expanded metal (galvanized steel) cable troughs as the distribution method that best suited the requirements of this specific installation.

Several factors led to the decision to use some 3,000 ft of trough on this project. In most cases, a single trough could take the place of several parallel conduit raceways. In fact, at one point in the system, one cable trough accommodated conductors that normally would have taken 22 parallel conduits. This offered a substantial installation economy, particularly in congested areas.

Use of center-post suspension instead of trapeze-type rods facilitated conductor installation. Multiconductor cables could be laid in the trays from the sides instead of having to be "threaded" through suspension rods. This feature was another time saver.

The "open" construction of the expanded metal trays affords more than adequate ventilation for the cables and eliminates the possibility of moisture traps due to condensation in the humid atmosphere. Should a section of trough corrode or rust out, it can be easily replaced without disturbing the circuit and control cables.

Distribution flexibility, particularly in the congested areas, was another factor in favor of the trough scheme. Sufficiently wide troughs were installed to permit easy addition of circuit and control cables for future motor installations. It is a simple matter to add

LOOKING DOWN TROUGH feeding group of pump motors. Junction box termination of conduit drop typifies motor takeoff method. Note single-rod, center suspension of trough to facilitate multi-conductor cable installation. Tray has plenty of spare capacity for future motor feed and control cables.

TYPICAL MOTOR CONNECTION from cable trough distribution system. Motor and control cables go from junction box down conduit drop to pushbutton pedestal at right. Screw-cover box (6-in. by 6-in. by 4-in.) under control is for splicing conductors and testing control circuits.

BACK OF PEDESTAL has tee fitting connecting conduit drop to box under pushbutton. Circuit conductors go through oil and moisture-tight flexible conduit connection to motor terminal box. Pedestal is made from 4-ft length of 8-in by 2¼-in. steel channel.

a conduit drop at any point along a trough run and carry the new cables down to a motor location.

To control reactance loss, 3-conductor cables were used for power circuits in the troughs and multi-conductor cables for control circuits. Two operating conditions influenced choice of cable insulation: moisture due to humidity and possibility of cable abrasion due to vibration. To protect against both, approved type RR, neoprene-jacketed multi-conductor cables were selected. Resiliency of the neoprene covering more than justified use of this more costly insulation.

Economy, without sacrifice of system flexibility and quality, is an important design, installation, and operating consideration in any electrical system. On this project, estimated savings in material and labor, over a conventional conduit and wire installation, were confirmed when actual costs were tabulated. To the satisfaction of the owner and design engineers, the final tab showed a 28% saving over the estimated cost of a conventional raceway system.

To be more specific, one section of the trough system showed an installation cost of $7,100 for all labor and material. Cost of a multiple-conduit raceway system to serve the same purpose, based on use of an equivalent amount of single-conductor, neoprene insulated wire, would have been about $9,600. With Type RH-RW wires in conduit, the difference would have been somewhat less.

Comparative cost studies on a number of subsequent electrical system layouts have led to the establishment of the following design rule-of-thumb: when more than three multi-conductor cables (nine wires or more) are involved in a distribution method, consider the application of a cable trough system. As the number of required cables or circuits increase, correspondingly larger savings may result.

Takeoff Methods

The ease with which cables can branch off to individual motor locations, anywhere along a trough run, is one of the prime advantages of the trough distribution system. Fig. 1 shows a typical condition where some 25 motors are served from both sides of a 100-ft run of trough installed between two rows of tanks. Since most of the motors are controlled from two points, one at the motor and one at a remote station, this means two multi-conductor cables must be brought down to each motor. One is the power circuit; the other is the control circuit.

Rigid conduit drops carry the cables from the trough to the control pedestal alongside the motor. Connection from pedestal to motor leads is made with oil and moisture-resistant flexible conduit. To facilitate material handling and installation, individual motor drops were limited to 2-in. conduit. Where fill limitations permitted, multi-conductor cables were terminated with insulated bushings on a vertical steel plate support bolted to the side of the trough.

In case of larger motors, the 3-conductor power and 4-conductor control cables were terminated in a splice box fastened to the side of the cable trough. Extensions to the control button and motor leads were made by Type RH, single-conductor wires of corresponding size enclosed in the 2-in. conduit drop.

The simple, sturdy control pedestal at each motor consists of a 4-ft section of 8-in. by 2¼-in. steel channel. On its face is a pushbutton station nippled to a 6-in. by 6-in. by 4-in. screw-cover junction box which provides a handy splicing enclosure and access facility for the control circuit testing. Box, conduit drop, and flex connection to motor are connected by a 2-in. tee fitting at the back of each channel.

Trough Grounding

To assure positive ground continuity, every joint in the cable trough installation is bonded with bare No. 4/0 copper cable jumpers welded to the trough sections. Such bonding cost is negligible when you consider it is distributed to 20 to 30 circuits in the tray which otherwise would be in individual con-

duits. A separate ground wire was run in only a few troughs where the cross-sectional area of the metal was less than that required by the National Electrical Code for an equipment ground. For example: one run of 3-in. wide trough carrying a 3-conductor, 500 MCM cable was equipped with a separate ground conductor.

Several investigators have reported that when a fault to ground occurs on a typical conduit system, a high proportion of the fault current travels in the steel conduit even when a separate ground wire is in the raceway. Couple this with the facts that most conduit joints are painted with a "dope" to prevent rust; that couplings and bushings and locknuts at boxes frequently loosen and you have the makings for an arc that will provide a generous supply of sparks and hot metal until the joint is fused into a good connection.

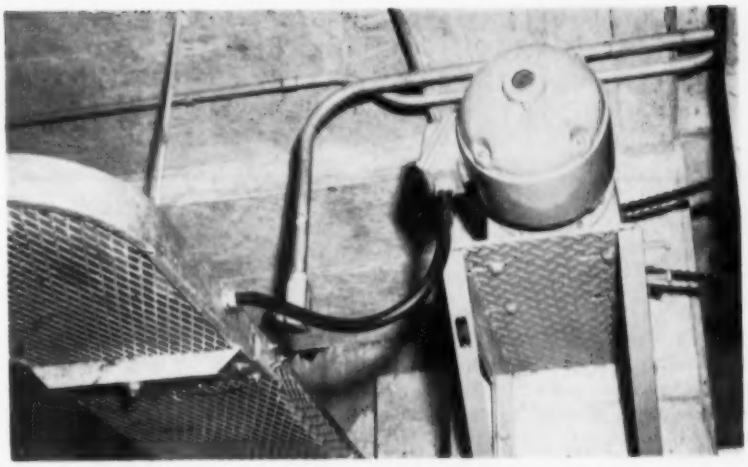
Such a shower of sparks around the usual combustibles in a paper mill constitutes a very real hazard. With a single run of bonded trough sections taking the place of multiple conduit runs, we believe the possibility of such a condition developing is considerably reduced.

Operating Experience

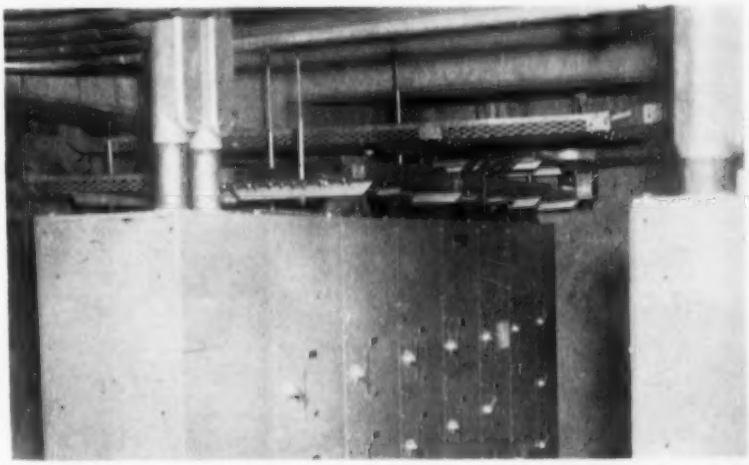
The initial cable trough distribution system has been in service in this plant for more than two years. Management reports that maintenance on the system has been "negligible" and that there has been no evidence of trough corrosion or cable abrasion to date.

In the interim, some 14 pump and agitator motors, each with two or more control points, have been added. No additional troughs were necessary. Multi-conductor circuit and control cables were merely laid in existing troughs and conduit takeoffs added at equipment locations.

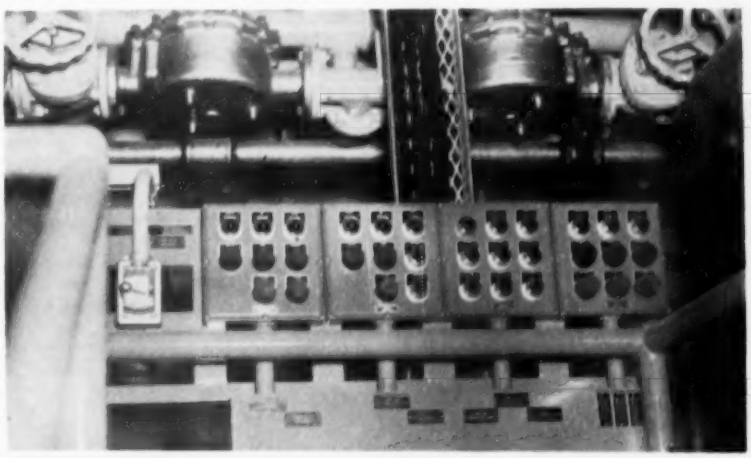
While the use of cable trough represented a fairly radical departure in distribution design for this plant, installation and operating experience confirmed the anticipated advantages. Definite installation and maintenance economies were effected. Flexibility and ease of circuit extensions have proved out. In fact, cable trays were incorporated in the design of a new Bleach plant just recently completed at the Central Mill. Electrical work for this project exceeded $100,000.



SIDE OF TROUGH elbow provides adequate support for flexible moisture-proof connection to shelf-mounted screw conveyor motor. 3-conductor cable from trough goes through flexible conduit direct to motor terminal box. Note center-support suspension of expanded metal pan.



SECONDARY DISTRIBUTION PANELS are the focal points of the cable trough system. Drop-out frames in bottom of troughs above panels provide smooth curved surface for cables dropping down to cubicles. Center-post suspension permits cables to be laid in troughs from sides.



REMOTE CONTROL STATION for a group of tank agitator and transfer pump motors is fed by multi-conductor cables in a vertical pan to distribution trough above.

HOUSEPOWER SALES AIDS

The green HOUSEPOWER Rating Sheet (for use in existing homes) is a sales tool. It enables the electrical contractor, his sales representative, or the utility company's home wiring advisor to interpret the HOUSEPOWER in an existing home in terms of *end use*. It is devoid of technical terms, excepting for the capacity of the service entrance, which is given in amperes.

HOUSEPOWER™ RATING

FOR RESIDENCE AT _____

THE ELECTRICAL WIRING IN THIS RESIDENCE

PROVIDES HOUSEPOWER FOR	BEFORE modernization	AFTER modernization	and can be extended for
Electric Range	☐	☐	☐
or Electric Oven	☐	☐	☐
and Surface Units	☐	☐	☐
Dishwasher	☐	☐	☐
Food Waste Disposer	☐	☐	☐
Kitchen Receptacles which permit the use of any 2 table appliances, such as broiler, toaster, etc., at the same time			
	☐	☐	☐
Electric Clothes Dryer: Regular	☐	☐	☐
Hi-speed	☐	☐	☐
Automatic Washer	☐	☐	☐
Electric Water Heater	☐	☐	☐
Ironer	☐	☐	☐
Room Air Conditioners in _____	☐	☐	☐
_____	☐	☐	☐
Central Air Conditioning	☐	☐	☐
Attic Fan	☐	☐	☐
Electric Workshop	☐	☐	☐
Refrigerator	☐	☐	☐
Freezer	☐	☐	☐
Electric Space Heaters in _____	☐	☐	☐
_____	☐	☐	☐
Furnace Mechanism	☐	☐	☐
Work Center Lighting	☐	☐	☐
_____	☐	☐	☐

The _____ ampere service entrance and the circuits and outlets in this residence are sufficient to provide HOUSEPOWER as checked above. Call the undersigned for any additions to your wiring system.

_____ _____

Electrical Contractor Address

BY _____ _____ _____

Date Phone

The face of the Sheet contains a space for filling in the address of the residence for which the HOUSEPOWER rating is being made, plus three columns for checking as follows:

Column 1, headed "Before Modernization": for use in interpreting the capability of the existing wiring system.

Column 2, entitled "After Modernization": to be used for checking off items not checked off in the first column, and which the customer indicates are under consideration for purchase in the immediate or near future.

Column 3, entitled "And Can Be Extended For": to be used for checking off those items not checked in either Column 1 or Column 2, and which the customer indicates are under consideration for possible purchase sometime in the future.

In other words, Columns 2 and 3 interpret, in non-technical terms, what the customer *can expect to get* from a wiring modernization job.

The blank line at the bottom can be used for inserting items which may not be included in the printed list.

Service Entrance Data: provision is made at the bottom of the Sheet for inserting the capacity of the service entrance. It can be used:

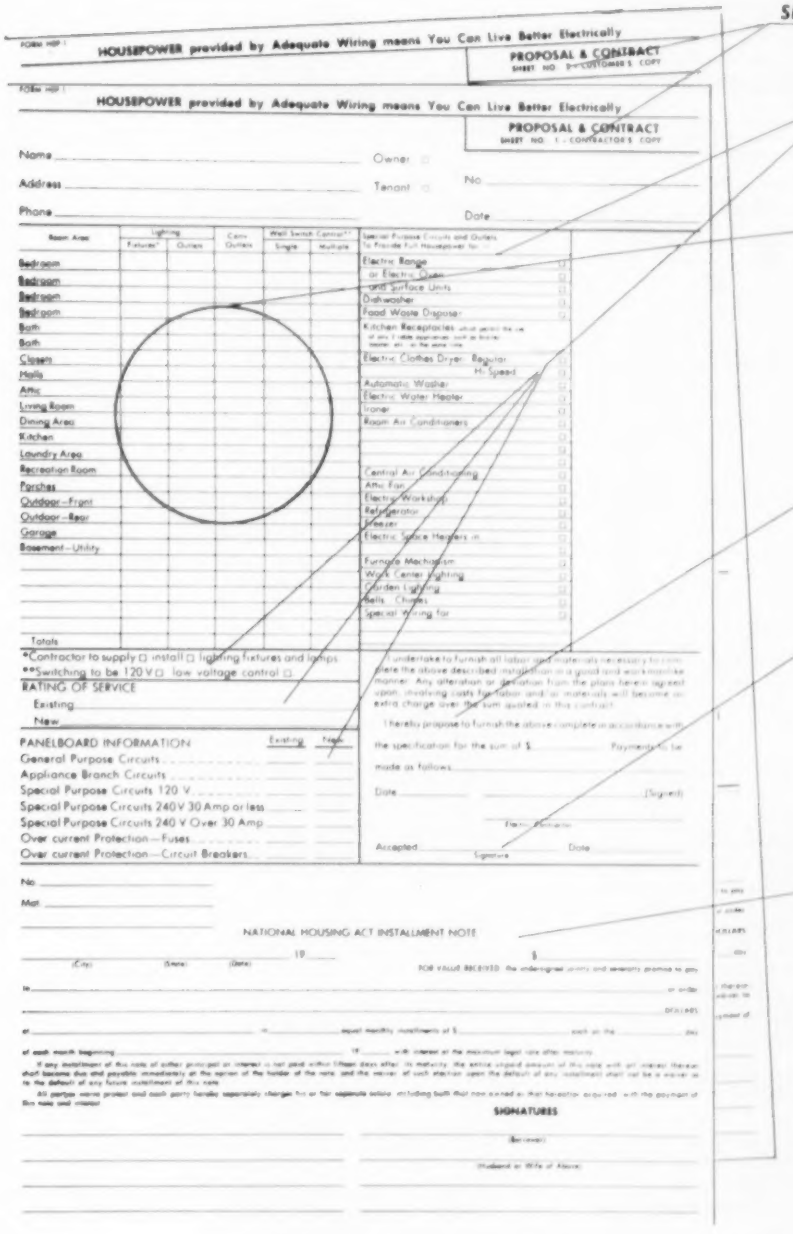
A. To show the capacity of the existing service entrance when neither Column 2 or Column 3 is checked.
B. To show capacity *recommended* in order to achieve the results desired, as checked in Columns 2 and 3.

Space for Contractor's Signature: for the electrical contractor's use, *only* after the wiring modernization job is completed, and the facilities checked in Columns 2 and 3 are actually available.

Practical forms, available from the National Adequate Wiring Bureau*, are designed to help the electrical contractor sell, plan and install residential rewiring and modernization.

* 155 E. 44th Street
New York 17, N. Y.

The HOUSEPOWER Estimate-Proposal Forms contain the detailed technical data which the contractor and the journeyman must have in order to figure the cost of the job and make the installation.


HOUSEPOWER provided by Adequate Wiring means You Can Live Better Electrically

PROPOSAL & CONTRACT

Name ____ Owner ☐

Address ____ Tenant ☐ No. ____

Phone ____ Date ____

Room Area	Lighting Fixtures*	Lighting Outlets	Conv. Outlets	Wall Switch Control** Single	Wall Switch Control** Multiple
Bedroom					
Bedroom					
Bedroom					
Bedroom					
Bath					
Bath					
Closets					
Halls					
Attic					
Living Room					
Dining Area					
Kitchen					
Laundry Area					
Recreation Room					
Porches					
Outdoor—Front					
Outdoor—Rear					
Garage					
Basement—Utility					
Totals					

Special Purpose Circuits and Outlets to Provide Full Housepower for ...

Electric Range ☐
or Electric Stove ☐
Hard Surface Units ☐
Dishwasher ☐
Food Waste Disposer ☐
Kitchen Receptacles (about which the use of any 3 table appliances such as toaster, mixer, etc., at the same time ☐
Electric Clothes Dryer Regular ☐ Hi-Speed ☐
Automatic Washer ☐
Electric Water Heater ☐
Ironer ☐
Room Air Conditioners ☐
Central Air Conditioning ☐
Attic Fan ☐
Electric Workshop ☐
Refrigerator ☐
Freezer ☐
Electric Space Heaters in ☐
Furnace Mechanism ☐
Work Center Lighting ☐
Garden Lighting ☐
Bells, Chimes ☐
Special Wiring for ☐

*Contractor to supply ☐ install ☐ lighting fixtures and lamps
**Switching to be 120 V ☐ low voltage control ☐

RATING OF SERVICE
Existing ____
New ____

PANELBOARD INFORMATION	Existing	New
General Purpose Circuits		
Appliance Branch Circuits		
Special Purpose Circuits 120 V		
Special Purpose Circuits 240 V 30 Amp or less		
Special Purpose Circuits 240 V Over 30 Amp		
Over current Protection—Fuses		
Over current Protection—Circuit Breakers		

I undertake to furnish all labor and materials necessary to complete the above described installation in a good and workmanlike manner. Any alteration or deviation from the plans herein agreed upon involving extra labor and/or materials will become an extra charge over the sum quoted in this contract.

I hereby propose to furnish the above complete in accordance with the specification for the sum of $ ____ Payments to be made as follows: ____

Date ____ (Signed) ____
Firm Name

Accepted ____ Date ____
Signature

No. ____
Mat. ____

NATIONAL HOUSING ACT INSTALLMENT NOTE

(City) (State) (Date) 19__ $ ____

FOR VALUE RECEIVED, the undersigned jointly and severally promise to pay to ____ or order ____ DOLLARS at ____ in ____ equal monthly installments of $ ____ each on the ____ day of each month beginning ____ 19__, with interest at the maximum legal rate after maturity.

If any installment of this note of either principal or interest is not paid within fifteen days after its maturity, the entire unpaid amount of this note with all interest thereon shall become due and payable immediately at the option of the holder of this note, and the waiver of such election upon the default of any installment shall not be a waiver as to the default of any future installment of this note.

All parties waive protest and each party hereby separately charges his or her separate estate, including both that now owned or that hereafter acquired, with the payment of this note and interest.

SIGNATURES

(Borrower)

(Husband or Wife of Above)

Sheets Nos. 1 and 2 are identical.

They contain a detailed description of the wiring to be done in order to provide the facilities checked in the second and third columns of the HOUSEPOWER Rating Sheet, plus an exact record of outlets, switches, and fixtures which the customer wishes to have installed.

They also serve as the contractor's written proposal.

When signed by the customer, they become a contract for work to be done, prepared in duplicate.

Installment Note. The National Housing Act Installment Note, attached to the bottom of the Proposal and Contract (Sheets 1 and 2) is a prototype note, recommended by FHA for use in connection with Title I FHA loans. It will be accepted by many financing institutions. However, a number of banks prefer to use their own note forms. If the prototype note cannot be used, or the job is done on a cash basis, the note form can be detached and discarded.

ESTIMATE SHEET
SHEET NO. 3

Sheet Number 3 **is the Contractor's work sheet, for use in preparing his estimate. It contains all of the wiring data (transferred by carbon) from Sheets 1 and 2, plus spaces for inserting the following additional data:**

BUILDING CONSTRUCTION DESCRIPTION

Number of stories	Attic
Exterior Walls	None ☐
Frame ☐	Inaccessible ☐
Cement Stucco on Frame ☐	Accessible ☐
Masonry ☐	Full Ceiling Height ☐
Masonry Veneer ☐	Unfinished ☐
Interior of Outside Walls	Floored Only ☐
Frame ☐	Floored & Ceiled ☐
Contact on Masonry ☐	Basement
Furred on Masonry ☐	None ☐
Inside Walls	Crawl Space ☐
Frame ☐	Full Ceiling Height ☐
Solid Dry Wall ☐	Unfinished ☐
Floors	Ceiled ☐
Pine T & G ☐	
Hardwood ☐	
Sub Floor Under ☐	
Cemented Floor Covering ☐	
Slab On Ground ☐	

A. Details of building construction, for the convenience of contractors who do not estimate on the spot, to aid them later in figuring installation time and procedures.

Special Purpose Circuits and Outlets To Provide Full Housepower for		Unit Price	Extension
Electric Range	☐		
or Electric Oven	☐		
and Surface Units	☐		
Dishwasher	☐		

B. Quantities and prices of all wiring and materials required. (This data appears *only* on Sheet Number 3)

	Quantity		
Lighting Fixtures			
Lighting Outlets			
Wall Switches — Single Pole			
Wall Switches — 3 way or 4 way			
Feeder			
Panelboard			
Service Equipment			
Service Entrance			
Allowance for Alterations			
& Additions Not Covered Above			
Permits, Fees, Etc.			
TOTAL PRICE			

C. Description of new wiring and equipment to be installed and the wiring methods to be used.

NEW WIRING & EQUIPMENT DESCRIPTION

Service Conductors	
Service Raceway	
Service Equipment	
Feeders	
Panelboards	
Wiring Method For General Purpose Circuits	
Wiring Method For Special Purpose Circuits	

JOB INSTRUCTIONS

D. Space for inserting job instructions.

WORK ORDER
SHEET NO. 4

Sheet Number 4, **printed on heavy paper, is the Work Order, for use by the journeyman. It contains all of the data, excepting costs, (transferred by carbon) from Sheets 1, 2, and 3, plus spaces for the following:**

Special Purpose Circuits and Outlets To Provide Full Housepower for —		Method	Wire Size
Electric Range	☐		
or Electric Oven	☐		
and Surface Units	☐		
Dishwasher	☐		
Food Waste Disposer	☐		
Kitchen Receptacles on 3-Wire appliance circuit with split-wired receptacles			

Wiring methods and wire sizes to be used.

INSTALLER'S NOTES:

Space for Wireman's own notes.

Completed: Date _____ by _____

Inspected: Date _____ by _____

Spaces for insertion of completion and inspection dates and name of inspector.

How to use — the Housepower Rating Sheet, Sales Visualizer and Estimate-Proposal Form.

The HOUSEPOWER Rating Sheet and Estimate-Proposal Forms are used *together*—to make the customer want a modernized wiring system, and to help close the sale on the spot. The HOUSEPOWER Sales Visualizer is a valuable adjunct to the HOUSEPOWER Rating Sheet. It helps overcome objections, and makes it easier for the contractor or his representative to get the customer's agreement on each sales point.

The "HOUSEPOWER Rating" might be termed the "door opener." Most customers will request a HOUSEPOWER Rating *only* when (consciously or sub-consciously) they believe their wiring to be below par.

When called on to make a survey of the wiring system, the electrical contractor, or the utility company's representative, proceeds as follows:

1. Makes a conventional survey of the wiring system, noting the service entrance capacity, number and capacity of branch circuits, etc. (An examination of the existing service entrance and the circuit distribution panel may be all that needs to be done at this stage.)

2. Using this data as a guide, checks in the first column those items which the wiring is already equipped to supply. *This may be left unsigned with the customer, if that is all that is desired.*

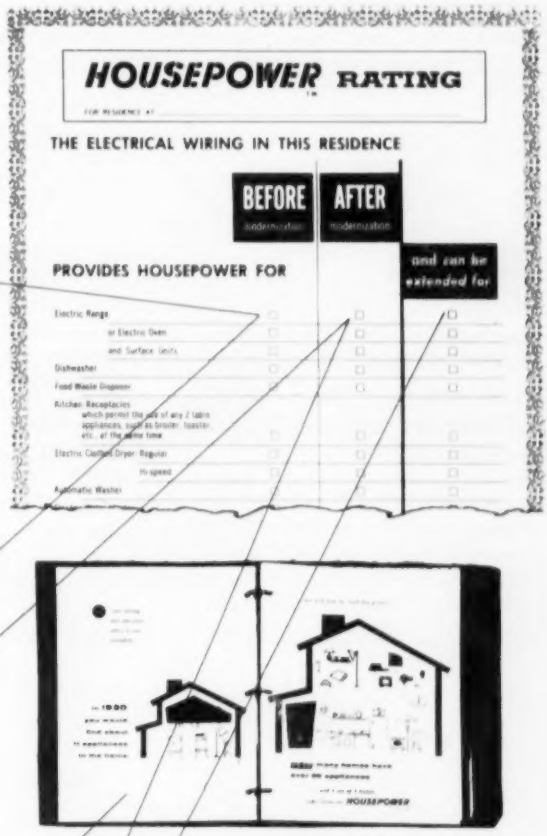
In most cases, the capacity of the wiring would not normally permit many items to be checked in the first column. Nevertheless, some of them may be connected to the existing wiring. If so, their presence is a clear indication that the existing system is overloaded, and quite possibly over-fused. Where this situation exists, it should be explained to the customer.

It is a well-known fact that a majority of homes have insufficient wiring for efficient use of the appliances now owned. This can be emphasized by checking, in the "Before Modernization" column, only those items for which proper service capacity and branch circuit wiring is already installed. Appliances connected to overloaded circuits, or for which there is insufficient service capacity, should be checked in the second column.

This is the time to point out that:

A. the customer is using all of the home's *present* HOUSEPOWER;
B. additional HOUSEPOWER must be installed before the customer can proceed to the next plateau of Living Better . . . *Electrically;*
C. improvements to the existing wiring system will permit *simultaneous* use of presently owned appliances;
D. installation of additional HOUSEPOWER will open the way for easy, economical installation of additional appliances which the customer may be considering.

3. At this point, the HOUSEPOWER Sales Visualizer can be brought into the picture, to help show the customer the benefits to be gained from a wiring modernization job.



4. Next, find out from the customer, through diplomatic questioning, which items listed at the left of the HOUSEPOWER Rating Sheet are under consideration. As the customer's future electrical plans are discussed, check:

A. In the second column, those items which the customer indicates are being considered for the immediate or near future, and
B. In the third column, those items which the customer indicates may be purchased at some undetermined future time.

• •

Thus, completion of the HOUSEPOWER Rating Sheet shows the customer what beneficial results can be obtained by having additional service entrance capacity and circuiting installed to serve those items checked in the second column. It also shows the items for which service entrance capacity will be provided—circuits for which can be installed when needed.

The HOUSEPOWER Rating Sheet *should not be signed by anyone at this stage.*

Enter: The HOUSEPOWER Estimate-Proposal Form

Room Area	Lighting		Conv. Outlets	Wall Switch Control**	
	Fixtures*	Outlets		Single	Multiple
Bedroom	•	•	•	•	•
Bedroom					
Bedroom					
Bedroom					

By this time the customer should be ready to discuss details, as a result of having been sold on the benefits to be gained from a wiring modernization job. Therefore, the time has come to take the customer on a "conducted tour" of the house.

This is the contractor's opportunity to sell *additional* features, in the form of extra lighting fixtures and outlets, convenience outlets, and switches. These items should be discussed as each room is visited.

As the customer's agreement to each item is obtained, the necessary data should be entered in the proper spaces on Sheet No. 1.

*Contractor to supply ☐ install ☐ lighting fixtures and lamps.
**Switching to be 120 V ☐ low voltage control ☐.

Be sure to identify the type of switching to be used, and to specify whether the proposal will include the price of the fixtures or merely the installation of them.

Special Purpose Circuits and Outlets To Provide Full Housepower for —	
Electric Range	☐
or Electric Oven	☐
and Surface Units	☐
Dishwasher	☐
Food Waste Disposer	☐
Kitchen Receptacles which permit the use	

The data on special purpose circuits and outlets is copied from the "After Modernization" (second column) on the HOUSEPOWER Rating Sheet.

RATING OF SERVICE	
Existing	
New	

PANELBOARD INFORMATION	Existing	New
General Purpose Circuits		
Appliance Branch Circuits		
Special Purpose Circuits 120 V		
Special Purpose Circuits 240 V 30 Amp or less		
Special Purpose Circuits 240 V Over 30 Amp		
Over current Protection—Fuses		
Over current Protection—Circuit Breakers		

Under "Rating of Service," enter capacity and number of conductors.

Under "Panelboard Information," enter the number of circuit terminations of each classification. Indicate by check mark whether fuses or circuit breakers will be used.

Thus, in one operation, the contractor has provided:

1. A detailed proposal of work to be done for the customer,
2. Data on which to base his estimate, and
3. Details of wiring to be installed, for the guidance of the journeyman.

• •

Making the Estimate

Special Purpose Circuits and Outlets To Provide Full Housepower for		Unit Price	Extension
Electric Range	☐		
or Electric Oven	☐		
and Surface Units	☐		
Dishwasher	☐		
Food Waste Disposer	☐		
Kitchen Receptacles on 3 Wire appliance circuit with split-wired receptacles			
Electric Clothes Dryer Regular	☐		

	Quantity		
Lighting Fixtures			
Lighting Outlets			
Wall Switches — Single Pole			
Wall Switches — 3-way or 4-way			

The Estimate Sheet (Sheet Number 3) can now be used to figure the cost of the job. The experienced estimator should be able to insert cost data in a very few moments, and to note specific equipment and material upon which it is based.

NEW WIRING & EQUIPMENT DESCRIPTION
Service Conductors
Service Raceway
Service Equipment
Feeders
Panelboards
Wiring Method For General Purpose Circuits
Wiring Method For Special Purpose Circuits

BUILDING CONSTRUCTION DESCRIPTION

Number of stories_____

Exterior Walls
- Frame ☐
- Cement Stucco on Frame ☐
- Masonry ☐
- Masonry Veneer ☐

Interior of Outside Walls
- Frame ☐
- Contact on Masonry ☐
- Furred on Masonry ☐

Inside Walls
- Frame ☐
- Solid Dry Wall ☐

Floors
- Pine T & G ☐
- Hardwood ☐
- Sub. Floor Under ☐
- Cemented Floor Covering ☐
- Slab On Ground ☐

Attic
- None ☐
- Inaccessible ☐
- Accessible ☐
- Full Ceiling Height ☐
  - Unfinished ☐
  - Floored Only ☐
  - Floored & Ceiled ☐

Basement
- None ☐
- Crawl Space ☐
- Full Ceiling Height ☐
  - Unfinished ☐
  - Ceiled ☐

During the "tour" of the house, the contractor will have made mental notes, which will enable him to quickly fill out the Building Construction Description, if this is needed.

I hereby propose to furnish the above complete in accordance with the specification for the sum of $_____ Payments to be made as follows_____

Date_____ _____(Signed)

Electric Contractor

The total price then should be transferred to the proper space on the Proposal and Contract (Sheet 1), financing terms arranged, and the sale closed.

The customer's copy of the Proposal and Contract should be attached to the HOUSEPOWER Rating Sheet, which was previously prepared, during the sales interview.

Preparing the Work Order

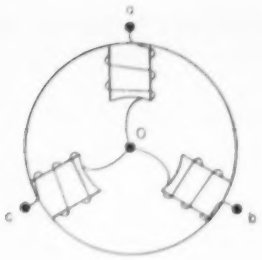
Special Purpose Circuits and Outlets To Provide Full Housepower for —		Method	Wire Size
Electric Range	☐		
or Electric Oven	☐		
and Surface Units	☐		
Dishwasher	☐		
Food Waste Disposer	☐		
Kitchen Receptacles on 3 Wire appliance circuit with split-wired receptacles			
Electric Clothes Dryer: Regular	☐		
Hi-Speed	☐		
Automatic Washer	☐		
Electric Water Heater	☐		
Ironer	☐		
Room Air Conditioners	☐		
	☐		
	☐		

The Work Order (Sheet Number 4) can be completed later, at the contractor's headquarters. The wiring method, wire sizes, and any special notes are all the data which will have to be added.

***After Modernization Work has been completed,* the electrical contractor (not the utility representative) signs and dates the HOUSEPOWER Rating Sheet. Only then is there assurance that the facilities shown in the second and third columns are actually present in the home.**

It is not necessary that only one Rating Sheet be used throughout this procedure.

The final sheet becomes a concise record, not only for the customer, but also for the electrical contractor to use when planning future wiring additions. This is especially true if the electrical contractor keeps a copy for his own record attached to the detailed Estimate-Proposal Form. By referring to his copies, the contractor has a ready index of just what wiring he has previously installed in the home.



Motor winding schematic to which vector diagrams apply
Point O is fictitious if motor is delta connected

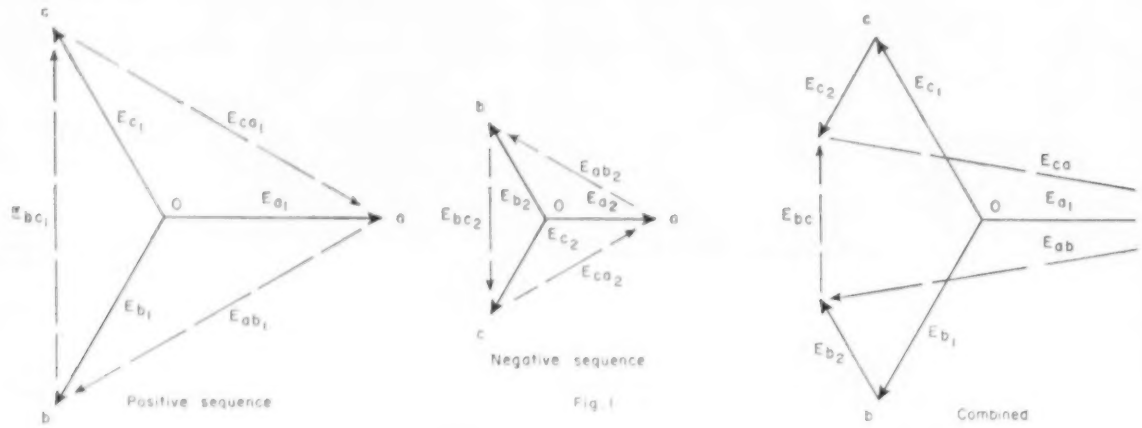


Fig. 1

VOLTAGE UNBALANCED EFFECTS

Small unbalances in the 3-phase voltage supplying induction motors produces large current unbalances. Effect produces unwanted tripping of overload devices and overheating.

SMALL unbalances in 3-phase voltages supplying induction motors result in relatively large current unbalances. Since the current unbalance is usually five to ten times as large as the voltage unbalance, a voltage unbalance of as little as 3% or 4% can cause tripping out of motors which are not overloaded or defective.

If an unbalanced 3-phase voltage is analyzed[1], it will be found that it can always be broken down into two sets of balanced voltages, one of which gives rise to a field rotating in reverse with respect to the other. See Fig. 1. Regardless of line voltages ab, bc, and ca, a balanced system of voltages with the sequence a_1-b_1-c_1 can always be found which when combined with a second balanced system with the sequence c_2-b_2-a_2 will give the original voltages ab, bc, and ca.[2]

It will be seen that the positive sequence set in Fig. 1 corresponds to normal balanced line voltage, so that the remaining negative sequence set represents the unbalancing components.

Both sets give rise to rotating fields; the positive sequence set, since it is normally the larger, causes the rotor to turn with it. Therefore the motor is driven against the rotation of the negative sequence field. The effect, then, as far as the negative sequence field is concerned, is the same as plugging, and a large unbalancing current flows.

1. *See Symmetrical Components, Wagner and Evans.*

2. *It is assumed that no neutral connection is made which will permit zero sequence currents to flow.*

Fig. 2 shows the relationship between line currents and voltages for small voltage unbalances calculated for a typical 5 hp, 220-volt, 3-phase, 1725 rpm, general purpose motor. The effect will generally be more severe for larger motors. Since the heater coils are usually selected to trip the motor at about 125% of rated current, Fig. 2 shows that this motor will trip out if the line voltage is unbalanced by 4.3% or more.

Normally, the frequency of the circulating rotor currents is very low—three or four cycles per second. Since the rotor is rotating backwards as far as the negative sequence field is concerned, the unbalance currents in the rotor have a frequency near 120 cycles per second. Consequently, the heating effect of these unbalance currents is much larger. Generally, the heat-

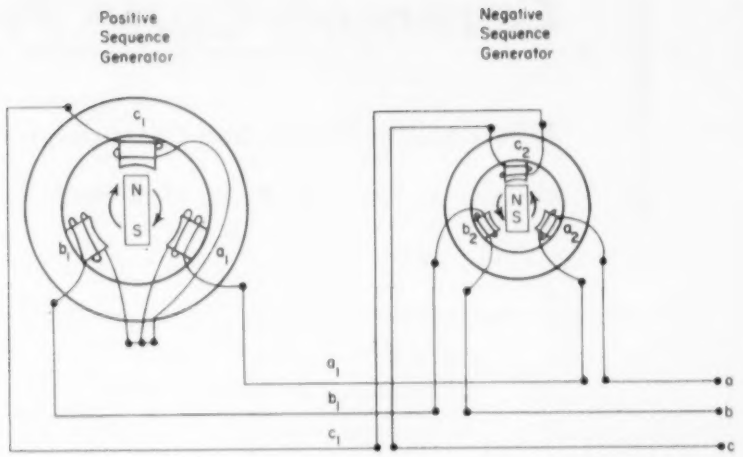


Fig. 1A

Demonstration connection of two generators to produce voltages shown in Fig. 1. By adjusting phase angle of one machine with respect to the other, and output voltages of two generators, any voltage that can exist on a 3-phase line (without neutral connection) may be duplicated.

ON MOTOR CURRENTS

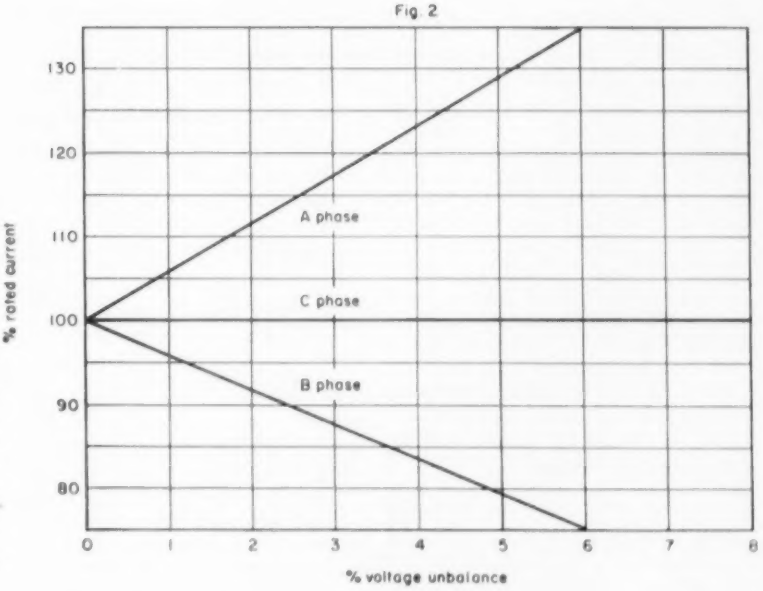
By E. J. Polasek
Consulting Electrical Engineer

ing effect is roughly of the same order as the current unbalance; that is, a 4.3% voltage unbalance will increase the heating about 25%.

Unbalanced voltage may be due to a number of causes. Most common, perhaps, are unevenly loaded transformer banks, open wye or open delta banks with substantial single phase loads on one unit, or feeders with combinations of single phase and motor loads. Very occasionally, the primary feeder may be unbalanced, perhaps because of improper regulator setting or unbalanced load.

Attempts at balancing the voltage at the motor are generally not very successful. Sometimes the addition of phase balancing induction MG sets is resorted to, but it is usually more economical to correct the condition at the source.

Fig. 2



Assumed motor constants:
R (rotor and stator), 4 %
X (rotor and stator), 8 %
Slip at unit load, 4.16 %
Positive sequence impedance at rated load, 100 @ 9.1°
Negative sequence impedance at rated load, 17.1 @ 20.5°

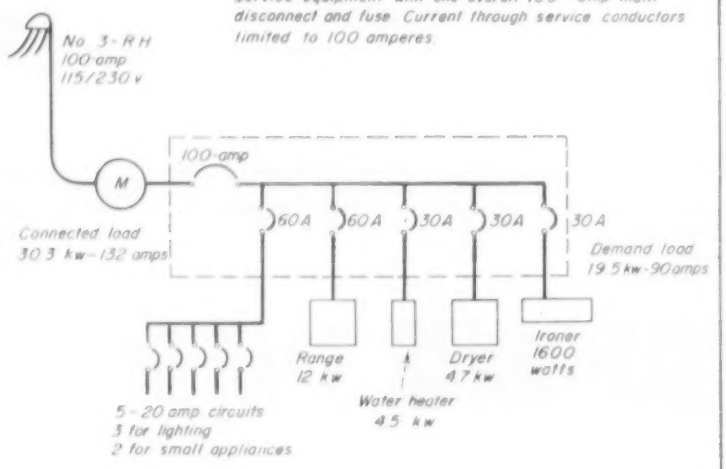
Common Code Problem

• Service Disconnects and Overcurrent Protection

By B. A. McDonald

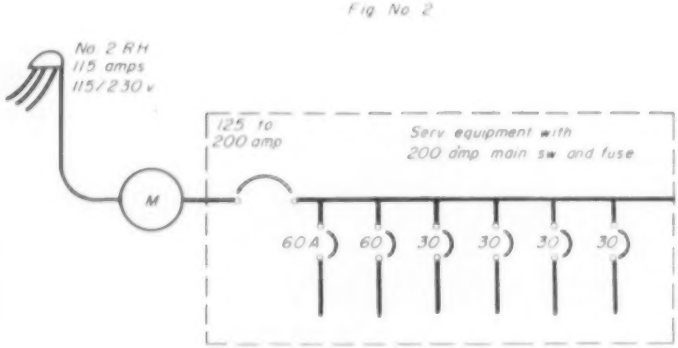
Fig. No. 1

Service equipment with one overall 100 – amp. main disconnect and fuse. Current through service conductors limited to 100 amperes.



No overall main disconnect and overcurrent device. Current not limited. 210 amps. may flow.

Fig. No. 2



In this case the protection afforded by the main disconnect is less effective, since it may be fused as high as 200 amps.

What is the case for a single means of service disconnect? Does the added safety warrant the additional expense? Are multiple disconnects creating future problems? The author discusses the pros and cons of a currently controversial problem.

Sections 2351 and 2371 of the National Electrical Code recognizes the use of up to six sets of disconnects and overcurrent devices on a single service entrance. Many communities, however, still require a single disconnect. Questions relating to this subject arise frequently in Code conferences. A review of the background will help to bring the problem into proper perspective.

The 1928 Code, through Section 405-C-4, first recognized the principle of more than one service disconnect and overcurrent device, by providing for two, three or four sets of service equipment when a similar number of meters were involved. The 1933 Code recognized such procedure regardless of the number of meters. The 1937 Code recognized, in general, for the first time, six sets of service disconnects and overcurrent devices.

It is significant to note however that the 1931 Code, through the provisions of Section 405-b-2, recognized six circuit breakers as the service equipment for a single family dwelling. Many will recall this innovation where each of the circuit breakers served as the branch circuits, and the capacity of the service entrance conductors was determined on the basis of the sum of the setting of each circuit breaker. This Code provision, some 26 years old, limited to a single family dwelling, undoubtedly was the forerunner of the present provisions of Sections 2351 and 2371.

It is quite evident, from the fore-

going history of the rules in question, that the principle of multiple sets of service equipment has been extensively applied in the field over a period of 28 years, and this experience has been favorable. As a result, it is difficult for me, from a standpoint of safety or hazard to agree that the present Code provisions should be discarded in favor of a single means of disconnect and overcurrent protection. I do not believe we should revert to the old concept of protection formulated in the early days of our wiring industry. My opinion in this respect is also influenced by the fact that the present provisions have, with some few exceptions, been generally accepted by inspection authorities in all sections of our country for many years, and such recognition would not prevail if any noticeable hazard was involved.

Increasing Loads

As our electrical loads continue to increase in all types of occupancies, it becomes more difficult to channel the required current through one set of service equipment. On large industrial and commercial installations, it would be impractical to do so without resort to primary disconnects and overcurrent devices.

I recall the day when the Code only recognized a single set of service equipment. Additions could not be made unless you threw out the old equipment and installed larger new equipment. I recall several installations where service switches of large capacity only a few years old were discarded and replaced. To me, this was a waste of material and labor which could have been avoided if the Code had permitted the installation of a second service switch. From a standpoint of hazard, it was difficult to explain to the owner why he had to throw away his old equipment and purchase new larger and more costly equipment.

Insofar as residential occupancies are concerned, it is evident that the manufacturers of service entrance equipment find a demand for both types of equipment. Some combinations are provided with one main disconnect while others have as many as six disconnects. This practice undoubtedly reflects a difference of opinion with respect to the Code provisions and the degree of safety established.

Fig. No. 3

Service fusing compared to service capacity

Multi-family dwelling six apartments, each 1,000 sq. ft. floor area. 12 k.w. range for each apartment

Computed load each apartment

General lighting	1,000 x 3 w = 3,000 watts	
Small appliances	= 1,500 "	
Total	= 4,500 "	
Demand factor application	3,000 at 100% = 3,000 watts	
	1,500 at 35% = 525 "	
	3,525 watts	
12 kw range demand	8,000 "	
Total demand per apartment	11,525 watts	

Service entrance taps to each apartment 11,525 ÷ 230 v = 50 amp. No. 6 R or R.H.

Size of main S.E. conductors:

Lighting and small appliances 4500 x 6 = 27,000 watts

Demand factor application 3,000 at 100% = 3,000

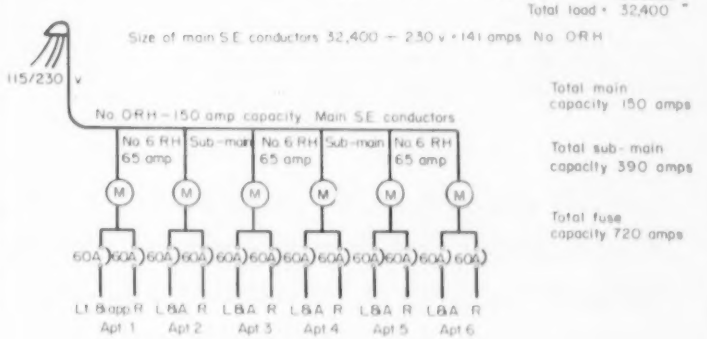
24,000 at 35% = 8400

Net computed light and appliance load = 11,400 watts

Range load 6-12 kw ranges = 21,000 "

Total load = 32,400 "

Size of main S.E. conductors 32,400 ÷ 230 v = 141 amps. No. 0 R.H.



Combination main and range service equipment

A correspondent raises another aspect of the problem. He describes a 100-amp panel, rated for use as service equipment, with five 220-volt disconnects which is, of course, permitted by the Code. However, he continues, with No. 3 RH conductors rated at 100 amps, if these five disconnects have only 35-amp fuses, the potential load on the conductors is 175 amps.

The above comment registers one of the principal objections to multiple service equipment. It is contended that the amount of current which may enter a residential occupancy, over a given size of service conductors, is not limited within a reasonable degree to the current-carrying capacity of such conductors.

Fig. No. 1 intends to clarify the point of contention. Here we have 100-amp service entrance conductors protected by a 100-amp fuse and disconnect or a 100-amp circuit breaker. While the branch circuits shown would permit as much as 210 amps to flow over the main if no main disconnect was provided, it also follows that the current will be limited to the size of the service conductors when the 100-amp overcurrent device is installed.

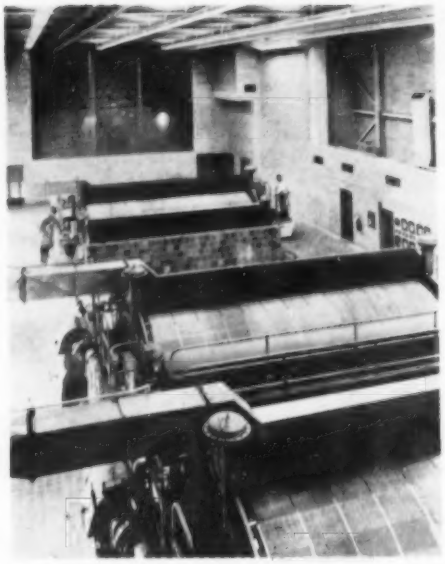
This particular combination definitely limits the current since the overcurrent device and the service entrance conductors have the same ratings. On larger services, this combination may not prevail unless the service conductor and the overcurrent device has the same rating.

Fig. No. 2 intends to emphasize this point. In this case the current-carrying capacity of our service entrance conductors is 115 amps. The main fuseholder, rated at 101-200 amps may contain a 200-amp fuse, even though the Code would require a standard 125-amp fuse. Under such conditions the service entrance conductors would be 75% over-fused. If, however, there were

[*Continued on page* 126]

CHOOSING CONDUIT FOR PULP AND PAPER MILLS

By V. S. Oakes, *Electrical Engineer*
Hammermill Paper Company



CONDUIT SYSTEM serving the operating floor in the bleaching plant is exposed to corrosive attack from bleaching chemicals and water vapor.

Unusual chemical conditions prevailing in the pulp and paper industry pose a special challenge to engineers who specify electrical products. Expected frequency of maintenance is an influencing factor in the proper selection of conduit and favors superior corrosion resistant finishes.

SPECIFYING policies based exclusively on "low first cost" are as outmoded as they are expensive.

The early failure—for example—of ordinary black enamel conduit when exposed to the corrosive environment of pulp and paper mill operations constitutes a definite hazard and creates a costly maintenance problem. Sound engineering, on the other hand, "adapts the conduit to the job" to avoid such circumstances.

Manufacturers are contributing to improved engineering with new conduits and new methods for protecting presently accepted materials.

Selecting the Conduit

Selection of conduit at Hammermill is based on the degree that available materials measure up to the general requirements of any electrical installation and to the more specific demands of the pulp and paper industry.

Generally, requirements include:

1. The conduit must be noninflammable—that is, the material used, or any protective covering, must not support combustion.
2. It must be rigid—have inherent strength and be reasonably self supporting.
3. Offer long-life potential.
4. Provide a smooth inner surface for pulling wires.
5. Should be relatively inexpensive.
6. Be as light as possible.
7. Offer a minimum resistance to hand-bending in the smaller sizes.

In our industry, conduit is frequently used in concealed locations where evidence of serious corrosion is seldom apparent until trouble with the electrical system develops. Conduit material must therefore be able to resist the prevailing corrosive conditions with a minimum of periodic painting and maintenance. Corrosive-resistant properties should not be affected by nicks, scratches and mechanical damage inflicted on the conduit during normal handling and installation.

Records and test board data compiled by our engineering department at Hammermill provide a modern approach to engineering economy in the selection of electrical conduit for a particular installation. Our information permits us to scale available conduit materials against the known requirements and provides a logical basis for comparison under actual operating conditions.

Our test board has been mounted in the sulfite mill since September 1955. It is subjected to corrosive fumes in that area. Atmospheric conditions to which the specimens are exposed include: acids of sulfur (principally sulfurous acids), organic acids and chlorine from nearby bleach settling tanks.

Attached to our test board are five different types of conduit. They include: 1. Black enamel, 2. Hot dipped galvanized, 3. Metallized-galvanized, 4. Aluminum, and 5. Sherardized conduit with an extra coating of acid-resistant enamel.

Types of electrical conduits available in all sizes and in general use today are analyzed here against a background of initial cost. The accompanying chart provides a comparative picture of relative costs of each conduit as it is discussed separately.

For purposes of comprehensive presentation, the cost of black enamel conduit is arbitrarily established at 100%, with the other conduits scaled to that "norm".

Conduit Evaluation

Black Enamel

This grade of conduit continues to be a serviceable product when installed under noncorrosive conditions and maintained by periodic painting. A single paint system does not assure adequate protection at pores and at the spots where the paint film is disrupted.

Even though the formulation and application of this baked enamel provides a tough, resilient, and continuous paint film, the service life of a conduit application is far too severe. Through the shipping, handling, threading, bending, and installation phases, numerous scars are left in the paint film. Unprotected steel areas start to rust almost immediately and the progressing corrosion travels underneath the coating until the entire surface is rusted.

If—as in some pulp and paper mills—black enamel conduit is installed in concrete slabs, the exposed risers in corrosive areas should be a higher quality conduit.

At Hammermill, black enamel conduit is seldom used—then only in auxiliary manufacturing areas where no corrosive conditions exist.

Hot Dipped Galvanized Conduits

The hot dipped process is performed by immersing a pipe in molten zinc metal and removing the excess metal from the interior by blowing it out with super-heated steam. This conduit is usually supplied with a baked on lacquer finish inside and outside of the conduit. The lacquer finish tends to provide a slick inner surface for the fishing of wires and helps minimize flaking of the outer surface when the conduit is bent. Hot dipped galvanized conduit costs 17% more than black enamel conduit.

Metallized-Galvanized Conduits

The exterior of this conduit is galvanized with pure zinc powder. Metallizing is performed with specially designed guns which supply the necessary force and heat to apply a tight, uniform coating. The metallizing operation eliminates cleansing and straightening operations necessary with the hot dipped process and therefore produces an easier bending conduit. An organic coating applied—by spray—to the interior provides the slick inner surface necessary for easy wire pulling. The exterior is similarly sprayed to provide added protection against conditions detrimental to the zinc coating. Metallized-galvanized conduit sells for approximately the same as the hot-dipped product.

Sherardized Conduits

This conduit is produced in an air-tight, sealed retort in which is placed the steel conduit and a specific amount of commercially pure zinc dust. The retort is placed on a mechanism that slowly revolves the retort and distributes the zinc dust over the entire exposed interior and exterior surfaces of the conduit. This process is conducted at a temperature of slightly above 800°F. The coating produced by Sherardizing is formed by the zinc alloying with the steel base metal. Subsequent layers of zinc penetrate the coating, increasing its protective thickness. The cost of this conduit is in line with both hot dipped and metallized-galvanized conduits.

RELATIVE COST VARIOUS TYPES OF CONDUIT

Fiber	43%
Black Enamel	100%
Hot Dip Galv.	117%
Metallized Galv.	117%
Sherardized	117%
Superduct	129%
Plastic Coated	188%
Aluminum	197%
Rigid Plastic	314%
Copper-Silicon	844%

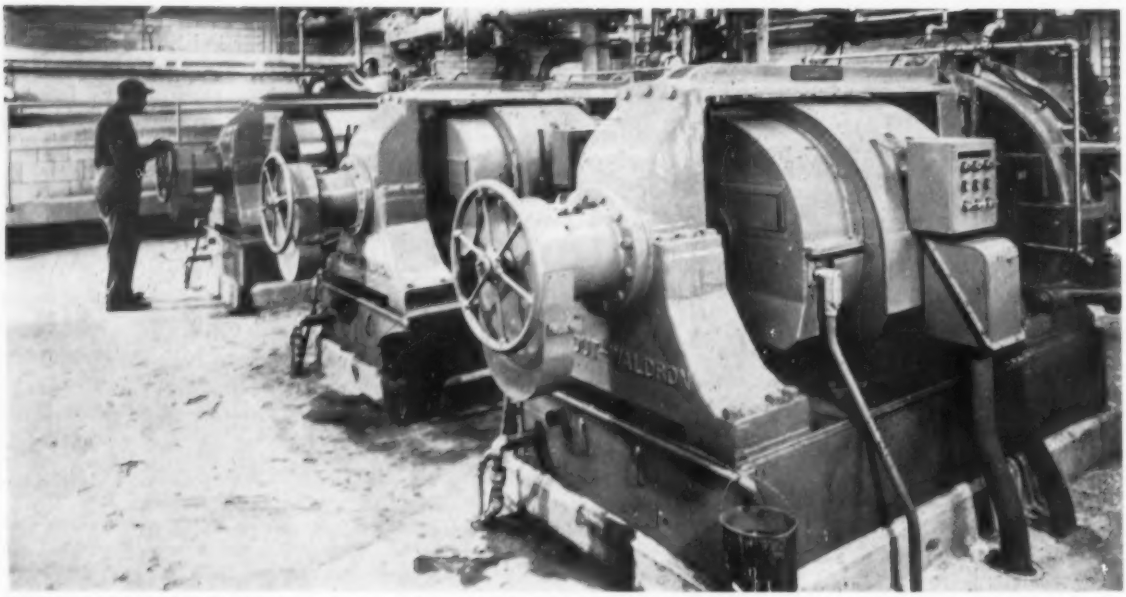
Sherardized-Enamels Conduits

A high quality Sherardized steel conduit has added corrosion resistance provided by a baked-on vinyl chloride-acetate copolymer enamel—a strongly adhesive and highly flexible protective coating that withstands extreme abrasions and reasonably high temperatures.

At a somewhat higher cost than zinc-protected conduit,—only 29% more than black enamel—it is, in the author's opinion, an excellent choice for general purpose applications as well as for severe ones.

At Hammermill, "Superduct", a

CLOSEUP of the control panel in the sulfur melting building. Conduit is exposed to corrosive attack of sulfur dust.



ON THE OPERATING FLOOR OF Hammermill's neutracel pulping building, chief corrosion agents to which piping and electrical conduit is exposed include sulfur dioxide, gas and water vapor. "Superduct", sheradized conduit with an enamel coating of vinyl chloride-acetate polymer, has proved highly resistant to the aggressive elements.

product of the National Electrical Products Co., is installed in our new neutracel plant where it is exposed to sulfur dioxide, gas and water vapor. In our bleach plant, it is subject to attack by aggressive bleaching agents and water vapor and in our modern sulfur melting building it is exposed to sulfur dust.

Other (zinc-coated) Conduits

Some zinc-coated conduits have additional protection provided by acid-resistant enamel or jackets of polyvinyl chloride or polyethylene. In the case of plastic-jacketed conduits, plastic tape may be used to provide a continuity of protection at couplings. Although this system may require an additional amount of labor to install, properly installed it should provide a high degree of chemical and mechanical protection for the conduits. This conduit costs 88% more than black enamel.

Types of conduits that should be considered, although they are not presently in general use in the pulp and paper industry, include:

Copper-Silicon Alloy Conduits

A top quality conduit is made from high strength copper-silicon alloy and has excellent corrosion resistance. Where there are high concentrations of acid fumes and in certain concealed locations, the added cost of copper-silicon alloy conduits may be a very sound investment.

Copper-silicon alloy conduits compare favorably in bending and threading ease with steel conduits. Its weight is approximately 20% more than steel conduits but this alone should not be a large negative factor.

However, it has found limited acceptance in the pulp and paper industry because of its relatively high cost. Its cost is approximately eight and one-half times as much as standard black enamel conduits.

Aluminum Conduits

Aluminum has some very desirable features: namely light weight, resistance to many chemicals and high strength. First cost, however, is approximately twice that of black enamel conduits. It should be satisfactory in locations where sulfuric or sulfurous acids are prevalent.

Severe corrosion results when aluminum is exposed to mixtures of chlorine and water. Because of the increasing importance of this metal and its steadily decreasing relative cost, applications of aluminum conduit will no doubt be made in the pulp and paper industry.

Reducing Maintenance

The importance of periodic painting must not be overlooked when considering means of controlling conduit corrosion in existing installations. Before the wide acceptance and use of zinc-coated conduits, painting was the only means of protecting the black enamel conduit from acid fumes and moisture. At Hammermill, a painting program is in effect which reaches all parts of the plant once every three to four years.

In the past, this procedure has been somewhat effective in controlling corrosion on exposed metals in the mill. However, the continually increasing cost of labor makes this program one which we might well eliminate.

Since the initial cost of a conduit installation is a very minor factor —percentage wise—it should not, obviously, be the deciding factor in the selection of material.

The modern trend in plant construction is to erect buildings which are as free as possible of repetitive maintenance attention. Tile walls and floors, corrosion-resisting process piping and similarly protected electrical conduits are all forward steps in that direction.

Our ultimate goal must be to provide "long-life" conduit installations which do not require the expensive protective benefit of periodic painting. An installation which does not need such routine attention is most economical. It is both justified and desirable to specify specially treated conduits for electrical installations in the pulp and paper mill industry.

Publicity techniques help to

PROMOTE RESIDENTIAL REWIRING

Texas contractor uses eye-catching advertising, uniformed electricians, and direct mail promotion, to stimulate interest in residential wiring modernization.

FORT WORTH electrical contractor promotes residential rewiring, and by doing so, has been selling an average of three rewiring jobs each working day for the past year. "That's what we figured the rewiring business lacked," says M. J. Owens, owner of the contracting firm. "We started some promotional excitement, and the way our business has increased has proven to us the need for publicity."

Owens has employed a variety of techniques aimed to get the maximum publicity. The firm's rewiring push got underway last year, with a short eye-catching advertisement in the personal column of the newspaper. The response was an average of 200 inquiries a day. Owens was convinced he'd better concentrate on the rewiring business. His promotions included dress uniforms for bonded electricians, trucks dressed-up with the Live Better Electrically symbol, and direct mailing pieces, which must be dipped in water before the message appears. It states that home wiring, like the message itself, is hidden, but important! These cards are going out to home owners of residences 15 or more years old.

The response on these cards, tied in as it is with the Texas air conditioning market, has been so good that he is limited to sending only 200 of the cards out each week. Says Owens: "Our business is 85% rewiring now, and it looks as though it will be 100% rewiring before long." The firm operates seven trucks to handle its rewiring and maintenance business. Each truck is a working electrical shop, fully equipped with a basic inventory. Every evening, the electricians list what material has been used on calls during the day and the truck is restocked before it goes out again the next morning. Two men work from each truck. To speed service calls and to give the office control over the fleet, all trucks are equipped with two-way radios. They are in frequent contact with the office, as is Owens himself, who has another radio in his car. The trucks are painted red and white and each displays a large Live Better Electrically sign.

All workmanship and materials are fully guaranteed. This provides an opening for followup work. Shortly before the guarantee expires, a letter is sent out reminding the customer of the warranty, and asking if there is any way in which the firm can be of service. This helps to make certain the customer is satisfied.

Owens is now using and seeking a copyright on the term, "nu-wire", because he believes that this is a better, more attractive term than "rewire". The firm hasn't run any newspaper ads, except for standard display items for months, but his business continues to increase. Mr. Owens assumes that with all his gimmicks and satisfied customers, the business will proceed to move along under its own power.

TRUCKS DECORATED with the Live Better Electrically symbol are eye-catching to prospective rewiring customers. The building also displays a large sign to promote wiring. All trucks are equipped with two-way radios.

MAINTENANCE PROCEDURES

. . . related to power system components

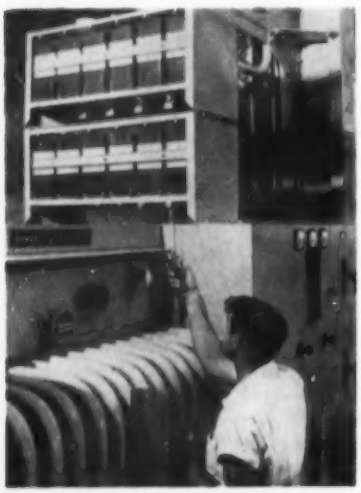
(Part III)

Power capacitors—minimizing penalty charges related to low power factors, and increasing effective system capacity by counteracting reactive current—can give peak performance over long life-spans if these basic maintenance recommendations are consistently practiced.

By Henry E. Heddesheimer, *Consultant on Electrical Engineering*
Plant Engineering and Maintenance Service, General Electric Co., Schenectady, N. Y.

USE of power capacitors in industry is becoming increasingly prevalent in order to (1) nullify low power factor penalty charges that are written into almost every electric utility contract (either directly or indirectly), and to (2) increase effective system capacities by counteracting reactive or "nonworking" current related to most motors, contactor coils and so forth.

Two basic schemes for installing capacitors are recommended: (1) locate individual units directly at offending equipment or (2) install capacitor banks at a substation or load center.



STACKED CAPACITOR RACK mounted on top of 750-kva load center is checked for voltage at capacitor terminals whenever a major circuit load or transformer tap is changed.

The simplest solution to power factor correction problems would be to install and switch capacitors conjunctionally with individual loads. Thus installed, capacitors would provide maximum benefits by relieving the entire distribution circuit (right up to the load) of the added burden of carrying corrective kilovars. This produces the greatest possible loss reduction and, in addition, voltage is improved, overall system capacity is released, and capacitors (when located at the load and automatically switched with it) are in use only when required; remaining out of service when not needed.

Because capacitors are made in standard sizes and many individual industrial loads are small, it would not always be practical to apply the exact kvars of capacity to each load. Furthermore, since all devices on a feeder are not operating at the same time, this diversity of loading permits equivalent correction to be obtained with banks of capacitors having smaller total kvar ratings than would be required in the event that all loads were separately corrected. Maintenance considerations likewise are important, inasmuch as inspection of many individual capacitors scattered throughout a plant would obviously become more difficult and costly than the inspection of a smaller number of larger banks.

On the other hand, a larger central installation would not be switched on or off with individual loads, and, during periods of light loading, switching arrangements might be advisable in order to prevent banked units from either (1) delivering higher-than-desired voltage or (2) overcorrecting plant power factor. When these several advantages and shortcomings are properly evaluated, the practical capacitor application will often result in the installation of individual capacitors directly associated with large loads, the balance of the recommended power factor correction being supplied by banks located at load centers.

Bank capacitor installations (usually located on top of a load center or in some other out-of-the-way place) are too often completely forgotten, although a few simple periodic inspections will prove to be good maintenance practice since these inspections can then assure that capacitors are in operative conditions and are giving the expected return on investment. Furthermore, this relatively inexpensive preventive maintenance procedure will give reasonable assurance that the capacitors will not be the cause of a possible subsequent power outage.

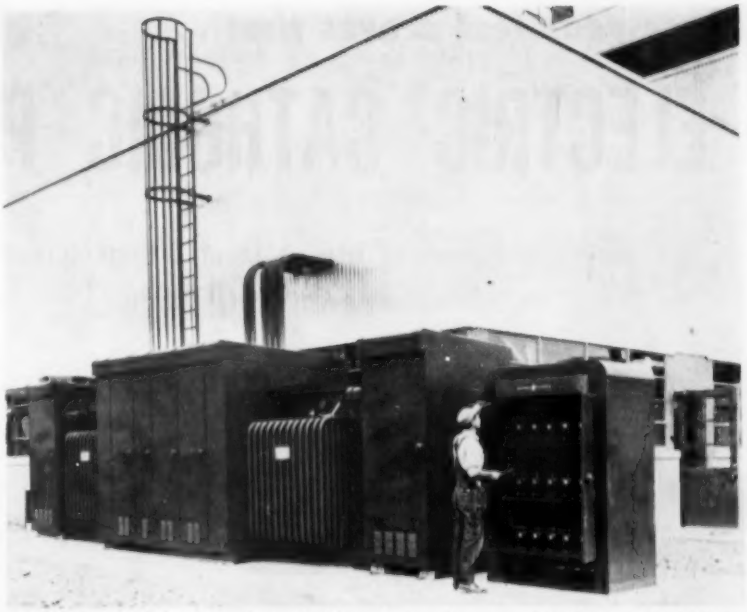
First a warning concerning personnel safety. Even though most power capacitors have an internal discharge resistor which reduces the voltage to approximately 50 volts within 5 minutes, it is still a necessary precaution to make use of an approved grounding stick when working on or around capacitors. Therefore, be sure to ground all terminals and maintain the ground

connection during inspection, cleaning and so on.

All power capacitors are designed according to NEMA standards and will operate satisfactorily at voltages up to 110% of their rating. However, at voltages higher than this, overheating can be expected, with resultant shortening of capacitor life and with fuses blowing due to excessive current flow.

All large power capacitors installed should be fused. If the dielectric in a capacitor fails, allowing a plate-to-plate arc, internal pressures are created due to the heat and gas generated. The amount of pressure thereby generated inside the capacitor will depend upon the magnitude and duration of current flow in the fault. It is essential that the type and ampere rating of the fuse originally supplied with the capacitor never be exceeded. Excessive internal pressures will, of course, cause the seams of the capacitor "can" to open and in some cases would cause damage to adjacent capacitors or to other nearby equipment.

Fuse blowing is probably the most common failure that will be encountered concerning power capacitors. Fuse blowing may be caused by excessive current due to capacitor unit failure, overheating, or, occasionally, by high voltage switching transients. A blown fuse is rarely found or noticed unless a planned inspection program is in effect.



CAPACITOR BANK related to double-unit transformer substation is checked for blown fuses twice a year, at which times bushings and capacitor tanks are cleaned and also checked to ascertain operating temperatures.

Avoid Over-Voltage

The most frequent cause of fuse blowing (high voltage) can be controlled by lowering the system voltage, using capacitors with higher voltage ratings, or (most practical and economical) by switching capacitors out of the circuit during normally high voltage periods. These high voltage periods are usually predictable; occurring usually on Saturdays or Sundays when the utility system voltage is high, as well as during second- and third-shifts, when plant inductive loading is usually at a minimum.

Switching may be either manual or automatic, with automatic switching controlled either by voltage, time switch, current, or kvar. The decision as to what method is best employed must be made individually, since it depends upon load characteristics, degree of correction desired, personnel facilities, plus the additional costs involved for automatic controls. The most popular method presently seems to be to assign an electrician or power operator the responsibility of switching capacitors (all or part of them) on or off manually in accordance with established production or working schedules.

The second most common capacitor trouble is operation at excessive temperatures. Any temperature in excess of 55 degrees C, measured by fastening a thermometer to the side of the capacitor, is too high, and corrective measures should be taken. A capacitor normally operates at relatively high voltage stresses, and dielectric determination will occur rapidly at higher-than-normal temperatures.

As the insulation deteriorates, normally low internal losses (one-third of 1%) increase, and the capacitor loses its high operating efficiency. Ultimately, internal breakdown will occur.

Excessive operating temperature can be caused by operating at higher-than-rated voltage, accumulated dirt, high ambient or poor ventilation.

The high voltage cause can be corrected as discussed for fuse blowing. The remaining causes of high operating temperature may be corrected as follows:

1) Establish a periodic cleaning schedule for all capacitors. A thin layer of gummy dirt can reduce the heat dissipation ability of the capacitor considerably.

2) Move the capacitor or capacitor bank to a location where ambient temperatures are lower, or provide forced ventilation to accomplish this objective.

3) In the case of a multiple capacitor bank, close proximity of capacitors causes mutual heating. These units should have greater separation or be provided with baffles to prevent the heated air from one capacitor convecting to the next. Manufacturers will supply information on request concerning spacing, baffling, etc.

To obtain full benefit from capacitors (operating at peak efficiencies with maximum life), the following preventive maintenance schedule is suggested.

1) Whenever there is a major circuit load change or a transformer tap is changed, check the voltage at the capacitor terminals and do not operate at any sustained voltage in excess of 10% of the capacitor nameplate rating.

2) Check for blown fuses at least every six months.

3) Clean the capacitor tank and bushings every six months, or more frequently in extremely dirty locations, and check the operating temperature.

Three-year test proves that . . .

ELECTRIC CATHODIC PROTECTION

can prolong life of steel pilings (erected in salt water) by at least 300%.

By Edwin P. Pitman, *Engineering Department, The Port of New York Authority*

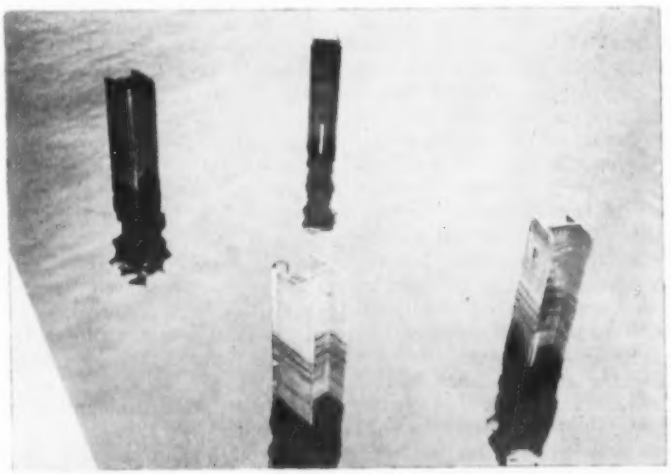
MAINTENANCE of steel pilings beneath docks and piers, particularly when such structures are erected in salt-tide waters, can be a source of definite concern and considerable expense. This is so because, under such conditions, corrosion can be rapid and replacement of pilings can be difficult.

This rapid rate of corrosion can be illustrated by a series of tests, now being conducted by engineers of the Port of New York Authority, wherein different types of pier construction, different tide conditions and different types of pier protection are being investigated. These studies will be continued for several more years, yet already it may be stated that (1) existing structures constructed by others have shown losses in flange thickness at certain points amounting to as much as 35% over a 7-year period in cases where no protection against corrosion has been provided, and that (2) in cases where protection *has* been provided, rate of corrosion has been reduced by 70%. Stated in another way, these tests show that the life of steel piling, with proper protection, can be materially increased.

Corrosion of pilings constitutes a major problem in any tidewater seaport. In a port the size of New York's, however (where 200 piers capable of handling 400 ocean-going vessels simultaneously are stretched along 650 miles of waterfront), the problem merits (and is receiving the most serious consideration, and analysis.

As a result of the findings, all piers now being erected by the Port Authority are incorporating facilities for the reduction of corrosion in the form of cathodic protection.

TIDEWATER PIERS in salt water, when supported by steel piles, present major corrosion problems that justify extensive research related to electric cathodic protection. Problem in port of New York is magnified due to extent of waterfront (650 miles) and great number of piers (over 200); a typical assortment of which are shown in this aerial photograph.



THREE TEST PILES (left; upper and lower center) were respectively protected against salt water corrosion by means of cathodic action plus asphalt paint, by asphalt paint alone, and by cathodic action alone. Fourth pile (at right) was left completely unprotected to provide basis for subsequent test inspections and measurements.

Cathodic Protection Defined

By definition, cathodic protection is the use of an applied current to prevent or to retard corrosion of metal surfaces. In the installations here considered, the function of such cathodic protection is to reduce corrosion (i.e., to reduce the rate of loss of iron) of H-piles and sheet piling passing through the salt water zone and driven below the mud line to a solid rock base.

As generally installed, these protective systems consist of four elements: (1) the *anodes*, or source of protective current; (2) the *cathodes*, or the surface of piling receiving the benefit of this protective current; (3) an *electrolyte*, which in this case is the corrosive sea water and silt through which the protective current flows, and (4) *rectifiers* which are the source of the impressed potential that drives the protective current. The adoption of rectifiers (in lieu of sacrificial anodes) was made on the basis of reliability of maintenance plus increased flexibility for the applications being considered.

These components may be more-readily visualized by referring to the accompanying "Types of Anode Suspension" and "General Wiring Diagram". Study of these diagrams will show that protective current from the positive (+) terminal of the rectifier is applied to the anodes. The current then flows through the water to the submerged pile surfaces, whereon the protective effect is achieved. The piles in each bent (i.e., in each row of parallel piles) are bonded electrically by a metallic conductor (reinforcing bars) to the building structure, and the collected current is finally returned to the negative (−) terminal of the rectifier.

Proper functioning of this protective system is monitored by an alarm system connected to the rectifier; all lights on the alarm panel in the control room remaining lighted under normal conditions, but darkening (with the coincident ringing of the alarm bell) in the event that the dc output of the rectifier drops below 50 amps.

During these tests it was determined that adequate protection of steel in sea water at this location could be attained when the structure has been polarized to a potential of minus 0.8-volts electronegative, when measured against a silver-silver-chloride sea-water reference electrode. Copper-copper-sulphate reference electrodes were also used, but were found to be inaccurate inasmuch as chloride ion contamination altered their potentials.

Pile No.	Protection		Loss in Flange Thickness		Reduction in Rate of Corrosion
	Cathodic	Paint	(Inches)	(Percent)	(Percent)
1			0.0160	330	.....
2		X	0.0129	267	19.3
3	X		0.0091	188	43.1
4	X	X	0.0048	100	70.0

WHARF DISCUSSED in this article consists of 232 bents, each one of which consists of four vertical steel piles and one diagonally-driven batten pile. Prior to driving, surfaces which were to remain above mud line were thoroughly cleaned and coated with coal tar application.

Details of Structure

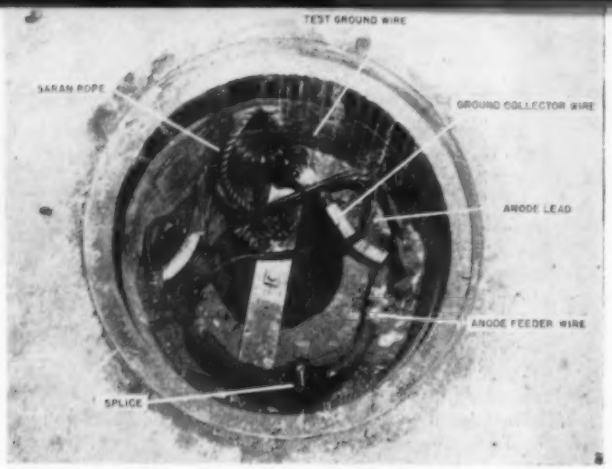
The first structure using cathodic protection was a 1650-ft wharf apron supported by 232 bents; each bent consisting of four vertical piles plus one diagonally-driven batter pile. Prior to driving, surfaces of piles (which were to remain above the mud line) were cleaned and coated with a coal-tar application.

Access handholes were located between each bent, while graphite anodes (4 in. in diameter; 80 in. long) were supported by Saran ropes and placed on the rip-rap below each handhole.

All piles were bonded electrically by means of lap-welded reinforcing bars at each bent, and two No. 8 insulated wires were brazed to the bars and brought separately to each handhole. One of these wires was connected to a common collector cable return to the negative (−) terminals of the rectifiers. The other wire was attached to an eye in the handhole for testing purposes. All anodes were connected to a common feeder cable supplied by the rectifiers (positive terminals).

The capacity of the dc system was premised on the basis of 5 milliamps per sq ft of steel surface in the water zone and 1-ma per sq

POTENTIAL OF TEST PILE is measured by voltmeter, with positive terminal of meter connected to reference electrode (via lead wire shown at left rear) and with negative terminal connected to test ground wire shown below lip of anode access handhole in foreground.



ACCESS HANDHOLES were located between each bent, while graphite anodes, supported by Saran ropes, were placed on rip-rap directly below handholes and connected as indicated by captioned leads in the above photograph of a typical installation.

ft of steel surface in the mud zone. Seven rectifiers operating in parallel, each rated 200 amps 15 volts (1 at 20 volts), were installed to fulfill the requirements. At each rectifier a shunt relay was provided to give visual and audible supervision at a central station.

Four test piles (with accurately recorded flange and web dimensions) were driven at one corner of the wharf; the first pile having neither coal-tar coating nor cathodic protection, the second having a coal-tar application to the mud line but no cathodic protection, the third having cathodic protection but no coating, and the fourth having both protection and coating.

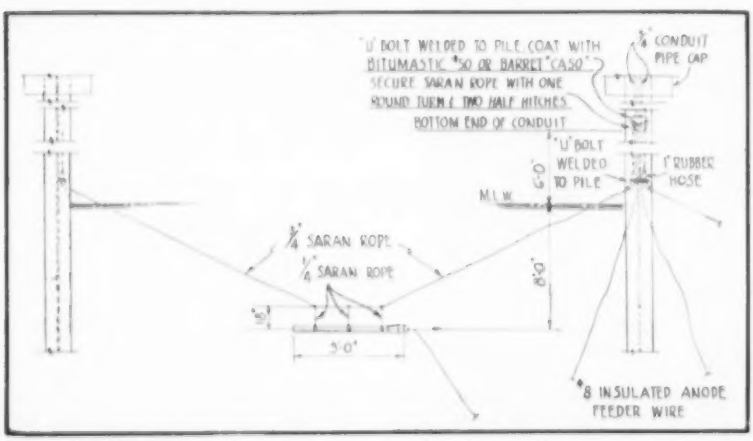
These piles, driven in September of 1953, were pulled and examined late last year, then re-driven with the intent of re-examination in 1960.

Results After Three Years

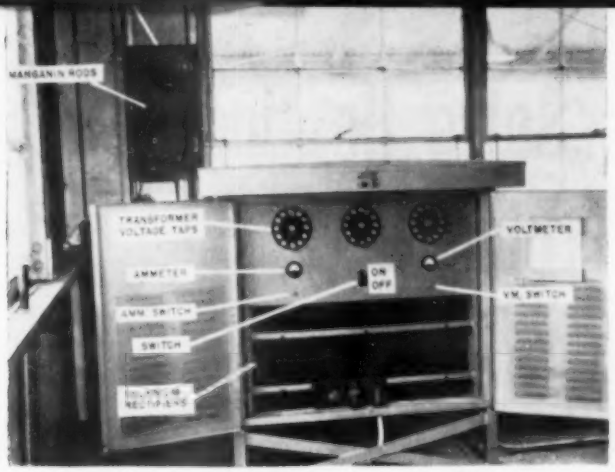
The test piles which were cathodically protected were connected to the protective system in January, 1954, approximately 4½ months after installation. Cathodic protection was withdrawn this past November, and piles were pulled for examination a month later. Piles which were cathodically protected, therefore, did not receive the benefit of that protection for a period of approximately 5½ months. Also, in June of 1954, one rectifier was inoperative for a brief interval, during which time the pile without a bitumastic paint coating received only 0.16 amps of protective current. It was also ascertained that, during this partial 3-year test, the average current density of the piles in the entire wharf structure received 1.06 amps, whereas the test piles were receiving only 0.62 amps at best. These findings lead to the conclusion that the test piles were without *any* protection, or were without *adequate* protection (to varying degrees) for about 12 months of the 38 months that they were installed.

In spite of these inadequacies, however, it was found upon measurement that loss in steel flange thickness (due to corrosion) was decreased by 19% through the application of a bitumastic paint coating only; by 43% through the application of cathodic protection only, and by over 70% through the combined application of a protective coating *plus* cathodic protection. Greatest reduction in corrosion was found to be just above the mud line, where completely *unprotected* flange showed 82% greater flange-thickness reduction than did its doubly-protected counterpart. Greater rate of corrosion just above the mud line was believed to be due to the scouring effect of the mud in removing the corrosion products, which, if left in place, would otherwise act as a corrosion-protective layer to the underlying steel.

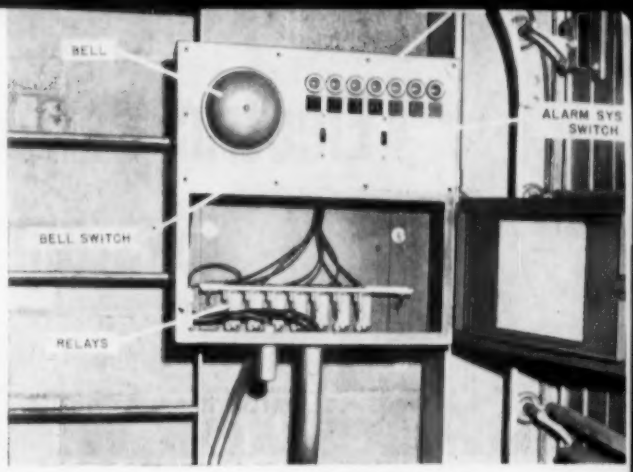
Port Authority engineers are recommending that the re-driven piles be connected to the negative collector of the cathodic protection


"U" BOLT WELDED TO PILE COAT WITH BITUMASTIC "50 OR BARRET "CA50" SECURE SARAN ROPE WITH ONE ROUND TURN & TWO HALF HITCHES BOTTOM END OF CONDUIT
¾" CONDUIT PIPE CAP
"U" BOLT WELDED TO PILE
1" RUBBER HOSE
6'0"
M.L.W.
¼" SARAN ROPE
¼" SARAN ROPE
8'0"
5'0"
#8 INSULATED ANODE FEEDER WIRE

GRAPHITE ANODE is supported by Saran rope below water level in order to minimize possible damage from floating debris and ice yet is suspended above mud and silt level to obtain longer service from anode. Graphite anodes perform best when water contains chloride ions, since chlorine evolved by an anodic product does not chemically attack the graphite.



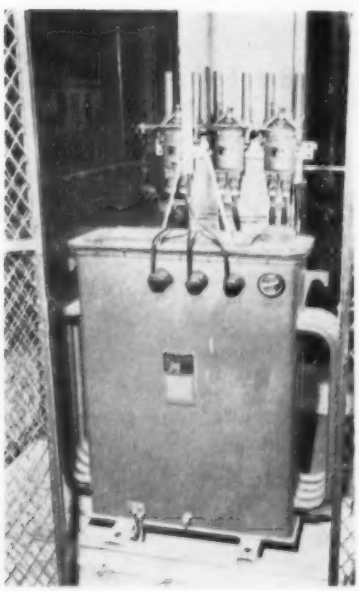
RECTIFIER UNIT and shunt relay used in connection with installation herein discussed. Seven rectifiers, each rated at 200 amps (6 at 15 volts; one at 20), were operated in parallel, with shunt relay at each rectifier location providing visual and audible supervision from central control station.



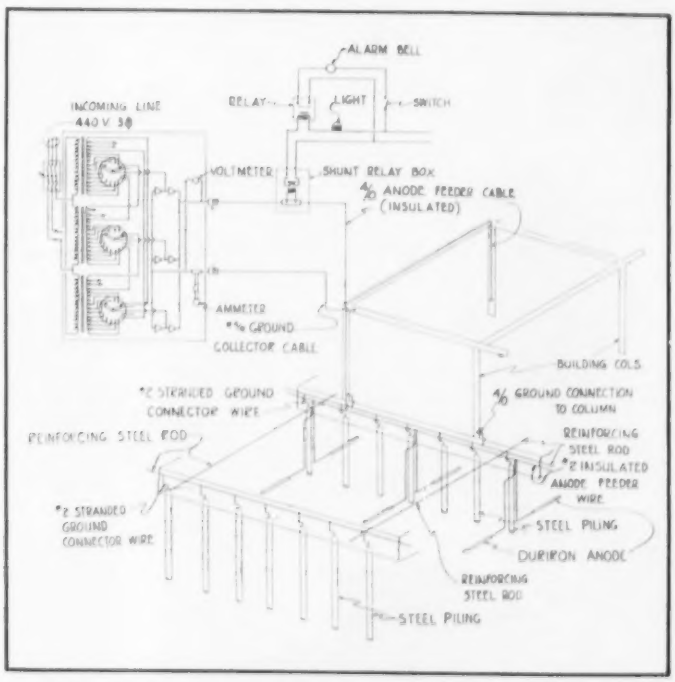
ALARM PANEL at central supervision station contains series of relays related to the seven remotely-located rectifier units. Should dc output at any rectifier drop below 50 amps, warning bell would summon attention of supervisor and related bullseye annunciator (normally lighted) would darken.

system with a 2/0 bond, and that the protective anodes be so located that the test piles will receive the same protective benefits that the structure as-a-whole has been receiving to date. It is felt that, with these changes, adequate pile potential will be maintained both in winter and in summer, and that the steel in both the water and mud zones will be fully protected against corrosion. This, of course, will not be positively verified until 1960 when the present tests are completed.

Interference tests made during this testing period also showed negligible or no change of potential on nearby substructures, or upon underground utility lead cables. These results constitute a definite demonstration that cathodic protection can extend the useful life of steel piers in salt water considerably, and PA engineers confidently predict that structurally sound lifespans of 50 years or more can be obtained through cathodic protection systems similar to the one herein described and discussed.



DISTRIBUTION TRANSFORMER that provides 449-volt, 3-phase current for rectifiers is installed, together with disconnect switch, directly upon wharf where test is being conducted. Transformer is protected by the surrounding wire cage enclosure shown in the above photo.



GENERAL WIRING diagram indicates how protective current from the positive terminal of the rectifier is applied to the anodes, with the resulting current passing through the salt water to the submerged pile surfaces whereon the protective effect is being achieved.

Electric Panels Solve Heating System Problems

New Hampshire residence uses radiant glass heating panels in heating installation totalling 51 kw.

ONE of the main problems of the prospective home builder is choosing the proper heating system. This was especially true in the case where the home was to be built in the cold ski country of New Hampton, N. H. The new owner took under consideration the uncertainties of fuel deliveries over snow bound roads, the difficulties of repairmen reaching his home, and a heating system that would give constant even clean heat for 67,718 cu ft of living space and 1,298 sq ft of garage and storage space.

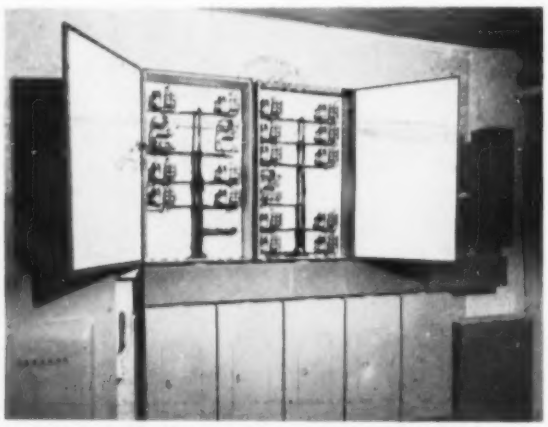
To prevent costly installation of ducts or pipes, and to preserve the open beam construction of his two story house, electric heating was taken into serious consideration. The owner sought the aid of Robert Harpell, architectural designer, Joseph Ezen, electrical engineer, S. L. Harpell, builder, and Clyde Spinney, electrical contractor, to help him solve his problem.

They selected Berko radiant glass type heating. Accurate heat control was assured by separately zoned low voltage thermostats in every part of the house. Hard to heat areas such as the attic, basement and huge living room proved easy to heat with the wide variety of heating panels available. Savings in installation were also noted, as compared to other types of heating.

RADIANT GLASS PANELS not only blend in with the decor of this room but also eliminates troublesome installation of heat duct or pipes in this construction.

The maintenance problem is practically non-existent because there are no moving parts and each heating element is made of tempered Pyrex glass that has been treated with an electrically conductive coating permanently bonded to the inside surface of the glass. A total of 80 radiant heating panels (51 kw) were installed, requiring a 400-amp service. The electrical contractor reduced the inductive hum of the relays by insulating the cabinet box that housed them at a centralized location.

ZONE CONTROL thermostats are important especially in the kitchen where room temperature may often vary.

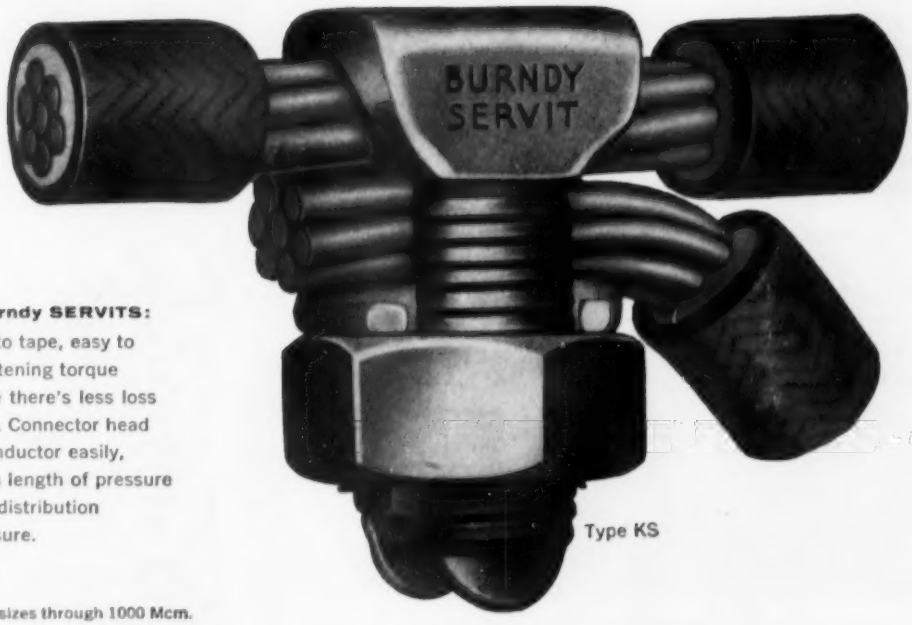


SERVICE ENTRANCE equipment and insulated cabinet box were designed by electrical contractor to house relays.

"Is this size approved?"

"brother... they're ALL approved!"*

SERVIT



Type KS

Know your Burndy SERVITS:
Compact, easy to tape, easy to install; less tightening torque needed because there's less loss through friction. Connector head fits over run conductor easily, exactly matches length of pressure bar for greater distribution of contact pressure.

*on all sizes through 1000 Mcm.

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55-10

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fill your needs exactly... buy Westinghouse

there are Westinghouse distribution panelboards just right for you—whether your concern is installation or long-time use. For the man who installs, they iron out the rough spots in electrical construction. Factory assembled to meet *your* specifications. For the man who lives with them, their convenient layout, ease of maintenance and safety mark them for preference every time.

for extra protection, the circuit-breaker-type panelboards are tops. Positive action circuit breakers with moulded-plastic cases are arranged for simplicity in wiring and absolute dead front. De-ion® grids extinguish arcs swiftly and surely. The Type CDP offers "screw driver" convertibility when load changes are required.

for extra economy, the Type FDP offers versatility, simplicity, dependable operation . . . at lower cost. A complete line of fusible switches, all equipped with De-ion arc-quenching grids and quick-make, quick-break switching mechanisms. Convertible in a wide range of combinations.

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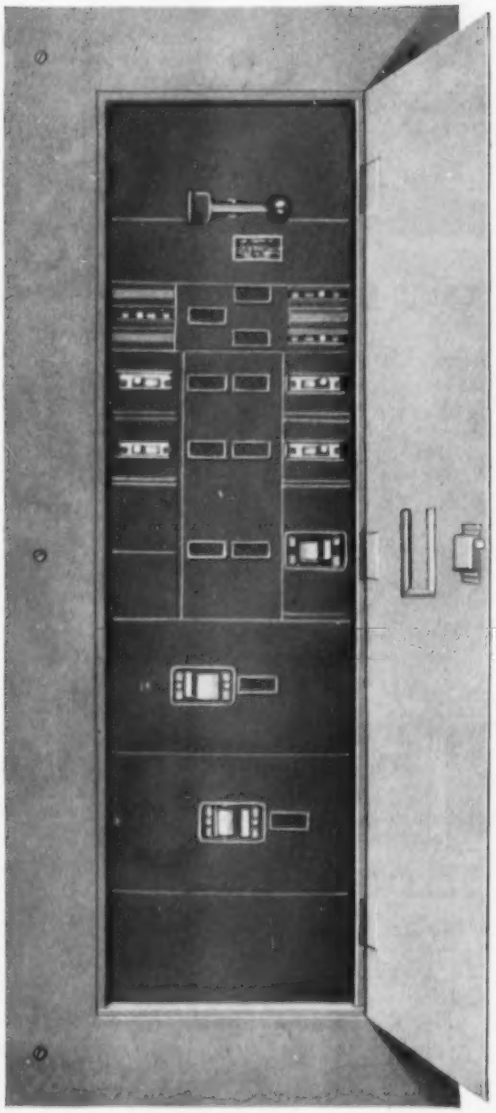
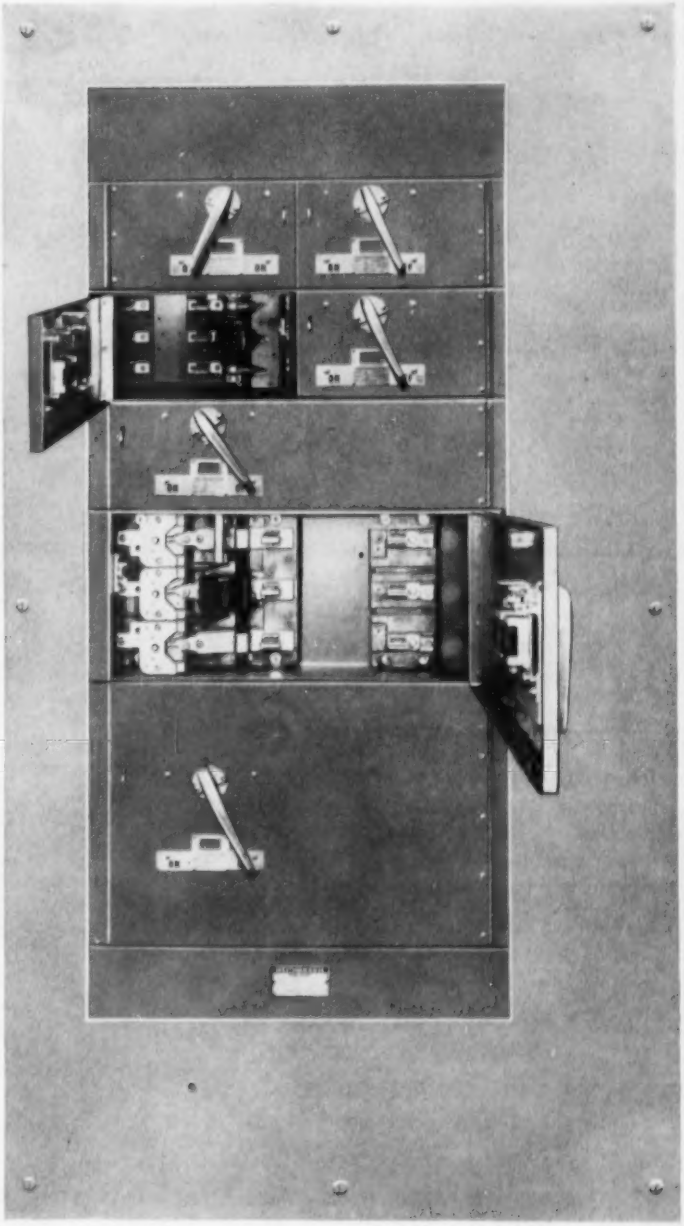


Type CDP Distribution Panelboard Utilizes E, F, G, J, K, KL, L and M frame AB De-ion circuit breakers; 15 - 800 amperes. Main lugs up to 1200 amperes—main breakers up to 800 amperes. Service voltages up to 600 volts a-c, 250 volts d-c.



Type FDP Distribution Panelboard Utilizes Type FDP De-ion fusible switch units; 30 - 600 amperes. Main lugs up to 1200 amperes—main switches up to 600 amperes. Service voltages up to 600 volts a-c, 250 volts d-c.

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Magnetic,
across-the-line
Motor Starters

INDUSTRIAL CONTROL

PYLETS

EXPLOSION-PROOF AND DUST-TIGHT

FOR HAZARDOUS LOCATIONS

SECOND TO NONE FOR . . . SAFETY AND ECONOMY. . . LONG SERVICE LIFE

NEW

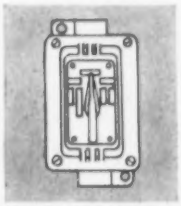
CORROSION-PROOF COVER JOINT:

The metal to metal joints of all explosion-proof Pylets, both the ground joint types and the threaded joint types, are cadmium plated to maintain the integrity of the flame arresting path against corrosion. Only cadmium plate can provide this valuable protection on ferrous alloy castings.

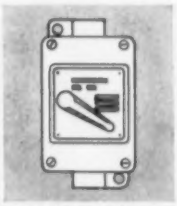
The new EMS motor starters, ECM combination motor starters and ECB circuit breakers have cadmium plated, ground cover joints plus the following features:

- COMPACT RECTANGULAR SHAPE
- HINGE SUPPORTED COVER
- RAIN-TIGHT PROTECTION
- COMPLETE ACCESSIBILITY FROM FRONT
- MINIMUM BENDING OF CONDUCTORS
- TAPERED TAPPED HUBS

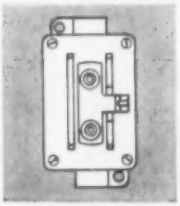
New ECB Series Circuit Breakers



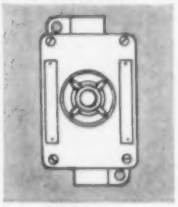
ER-SS Selector Switches



ER-M Manual Motor Starters



ERC Push Button Stations



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Practical Methods

Utility Building Promotes Good Lighting by Example

ILLUMINATION

Several examples of good lighting are visually evident to those visiting the Northern States Power Company building in Minneapolis, where modern equipment and practical application techniques are combined in various areas ranging all the way from an experimental kitchen, through a typical corridor, to their high-ceilinged machine shop.

As indicated in the accompanying illustrations, the kitchen is lighted by several mediums, including a 2-lamp warm-white fluorescent cove around the ceiling perifery, a series of recessed 150-watt downlights on 5½-ft centers in either direction, a central suspended panel above and inland sink consisting of four 8-ft T-12 slimline lamps shielded by corrugated plastic panels—the two end panels being pierced with partially-protruding collars for 60-watt downlights, plus several additional valances (above the range), and reverse coves (beneath hanging cabinets). All fluorescent lamps are deluxe warm white in color, while the color motif of the kitchen combines grey tiled upper walls, walnut woodwork, a white acoustical tiled ceiling, and a grey and salmon rubber tiled floor. Lighting is admirable on all work areas, with 100 footcandles measured at the sinks, 80 on the top of the electric range, 75 generally in other spots, with an absolute minimum of 50.

The general color scheme of the kitchen is also carried into the corridor, where a double row of rapid-start white 40-watt T-12 lamps, mounted end to end for the full length of the corridor, is offset along the side break in the suspended acoustical ceiling, and where the acoustical ceiling itself is equipped with recessed ring-baffled 150-watt incandescent floodlights. As indicated, the cove effect along one top of one wall, with the unique shielding method used to obtain a sharp cutoff angle and prevent glare from this lighting medium, lends interest to this normally-prosaic area. Lighting intensities at floor level approximate 45 footcandles.

Proceeding to the machine shop, one finds that intensities average 85-fc, with illumination being provided by 18 3-lamp clusters mounted at truss level on a 28-by-18-ft spacing pattern. Each cluster consists of two 400-w mercury vapor lamps plus one 1500-w incandescent, transformers for the former being mounted on the 3-lamp triangular frame, and reflector hoods being vented to improve ventilation and permit passage of dust-removing updrafts.

KITCHEN is illuminated by suspended central panel above sinks, auxiliary spotlights in the two end panels of this unit, continuous cove lighting around the ceiling's perifery, plus several valance treatments beneath wall cabinets and above cooking surfaces.

THREE-LIGHT cluster, including two mercury vapor and one incandescent lamp in each group, provide average lighting intensity of 85-fc in this high-ceilinged machine shop. Transformers for mercury lamps are supported by triangular framework above floodlight reflectors.

NOVEL 2-level ceiling treatment in corridor, with recessed downlights in the acoustical section and with two continuous rows of fluorescent lamps shielded by unique baffle arrangement along upper limit of one wall, provides considerable interest in this usually-prosaic area.

This area is all white, except for lower wainscote and red brick flooring. Large window and skylight areas also improve illumination during daylight hours.

COLORFUL TOWER, with rooster motifs backlighted from two directions by closely-spaced PAR-38 lamps, surmounts corner of open-front retail grocery store which is further distinguished and identified by two 75-ft-wide silhouetted-letter name panels. Parking area receives light from eight 2-unit 500-watt floodlight standards.

Light Used as Potent Sales Tool in Retail Food Store

ILLUMINATION

With all-glass walls, providing an unobstructed view of its 75-ft-sq interior, with brilliantly backlighted signs presenting its silhouetted name for the full width of two sides, with a unique arrangement of PAR lamps within varous-sized rooster "signature panels" atop its corner brick pylon, and with eight floodlight towers illuminating its vast parking lot, Colonial Stores of Roanoke, Va., dramatically illustrates the point that lighting is a potent customer-attracting and sales-promoting tool.

As indicated by an accompanying illustration, the broad exterior translucent panels above window lines, with closely-spaced horizontal rows of fluorescent lamps mounted continuously, provide an effective background for bold 3-ft-high lettering. Brightness of foreground in the exterior picture also gives some indication of parking-area visibility obtained from the eight 2-fixture floodlight standards (not shown) that are equipped with 500-watt PS52 incandescent lamps.

ILLUMINATION in order of 55 footcandles is obtained in this store from 2-lamp 8-ft channels surface-mounted on the acoustical tiled ceiling. Channels, spaced on 8-ft centers, are equipped with standard cool white T-12 lamps, while bins and shelves along walls are additionally highlighted by incandescent inside-frosted lamps placed behind continuous valance.

Of interest, also, is the "signature" tower, which presents two large and two small impressionistic roosters (one featured on each side of the square tower). These colorful birds are backlighted from two directions, for panel components have equilateral triangular planes; birds appearing on the hypotenuse, with PAR-38 floodlamps (spaced on 2-ft centers both vertically and horizontally) secured on the two equal-area sides of the triangular block, with their beams crossing to evenly trans-light the front panels.

Within the retail grocery store proper, a total of 95 surface-mounted 2-lamp channels, equipped with standard cool white 96-in. T-12 lamps, are used to form continuous lines of light spaced 8 ft apart across the 13-ft-high acoustical-tiled ceiling. General illumination from this medium averages 55-fc, while additional highlighting for merchandise and food produce displayed on wall shelves is obtained from seventy 2-lamp 4-watt inside-frosted incandescent lamps shielded by a wide custom-built inclined wall valance.

Submetered Apartment Distribution System

RESIDENTIAL

Electrical distribution in the 18-story apartment building built for 900 University, Inc., at Seattle, Wash., features grouped conduit and cable risers with combination distribution and submetering panels in electric closets on each

Mr. Plus proves his point

Electrically the smart new building of American Bakeries, Fayetteville, N. C., (below) is as modern as a plant can be. An all-Westinghouse system was installed by Barnhill Electric Company, working with Southern Builders, Inc. of Fayetteville. Some of the equipment installed is described on the next pages.

Think of having an experienced team coordinate delivery of such apparatus to meet *your* construction schedules. The team consists of . . . local distributor . . . Westinghouse field engineer . . . factory specialist. A similar team will score for you, too, in getting what you need electrically, WHEN and AS specified.

That's why we call the Westinghouse Distributor "Mr. Plus." He *does* give you something the ordinary electrical distributor can not.

DP-5034-A

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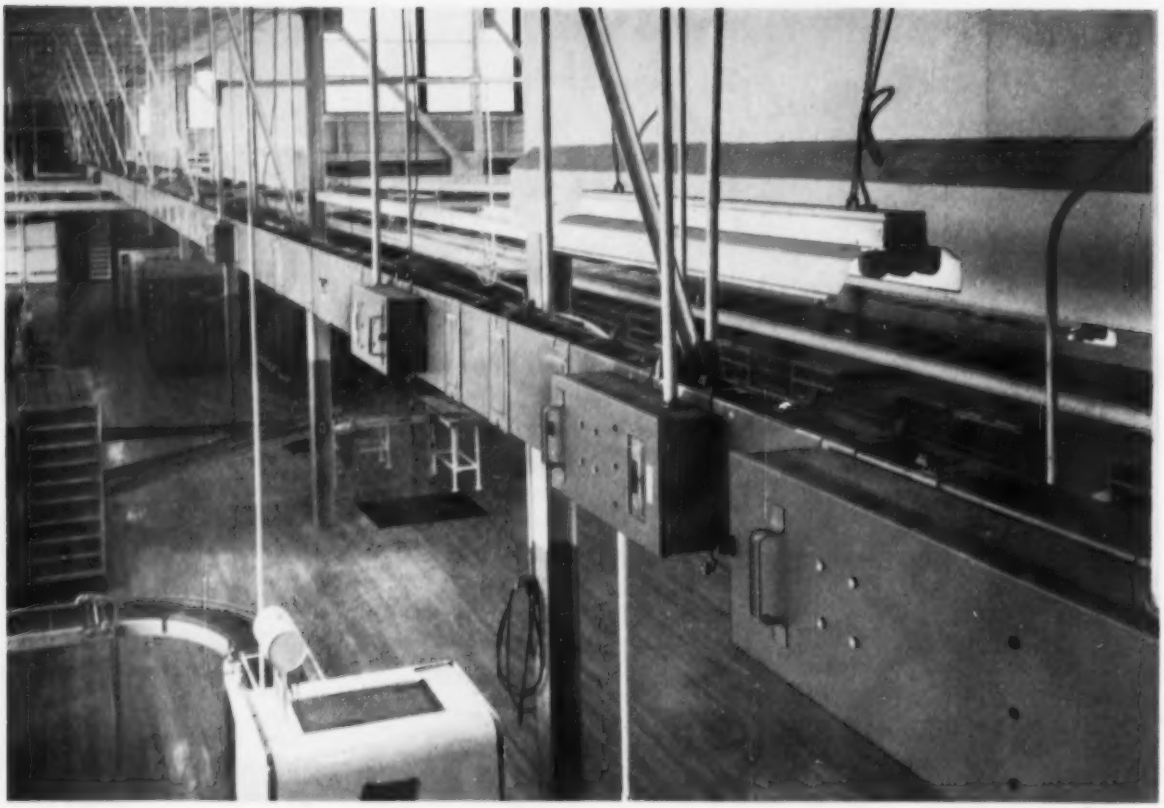
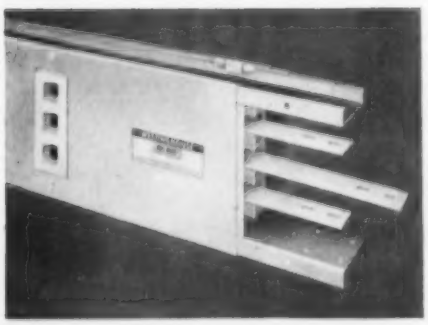
your Westinghouse Distributor



Safe and cool as an air duct, yet you "tap" its power wherever needed



Westinghouse plug-in bus duct offers many advantages in light weight, ease of handling. Available with copper or aluminum bus bars.

The American Bakeries installation is typical of the extra utility you get when Westinghouse plug-in bus duct is used. Lots of power is needed here . . . for mixers, conveyors and, most of all, the many baking ovens.

Wherever plant layout called for spotting a piece of equipment . . . there power was quickly tapped. Convenient plug-in units, with protective devices, attached easily to the duct. When changes are needed, plug-in units can be added without shut down yet with complete safety.

DP-5034-B

YOU CAN BE SURE...IF IT'S

Westinghouse

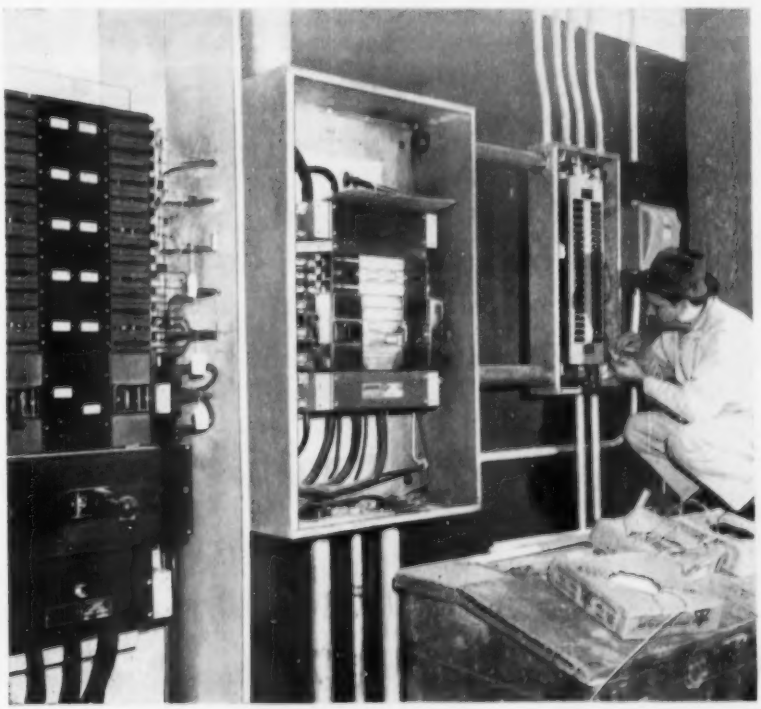
Westinghouse panelboards save you many a (Maintenance / Construction) "headache"

Whether your concern is installation of a distribution system or living with it forever after, you can prove that Westinghouse panelboards and switchboards can make life easier.

They are factory assembled, in units fitted to your specific needs. When they arrive on the job they *do* fit. The contractor is not left fussing and fuming to get the job done.

When they are in, that's that. Everything on the line, and those who handle it, are guarded by the types of protective devices best suited to the job in hand. They will last as long as the building in which they are installed, because that's the way Westinghouse engineers them. DP-5034-C

Buy everything electrical from MR. PLUS . . . your Westinghouse Distributor



The Westinghouse Building-Type distribution switchboard below can be adapted to many combinations of power requirements, and expanded to any capacity with standardized units.

At left, a power distribution panel and a lighting panelboard, typical of Westinghouse equipment in the American Bakeries plant. Ask for bulletins on Westinghouse panelboards or switchboards.

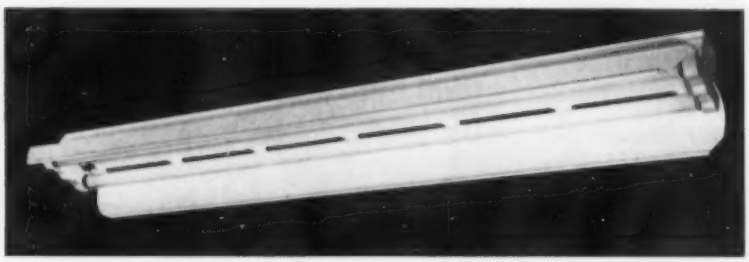
"Invisible" benefits help to make Westinghouse lighting pay for itself

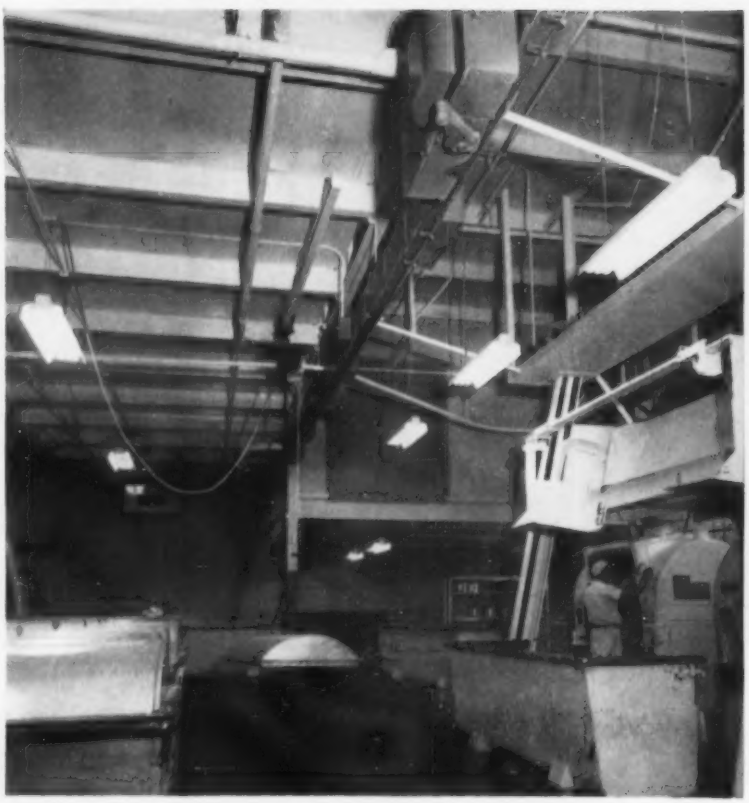
There is more to good lighting than meets the eye.

To the construction man, there's the question of fixtures that can be handled and installed without excessive damage. And the matter of installation as units or continuous troughs . . . ease of hanging.

Maintenance men want durability, ease of cleaning or replacing lighting elements . . . long life. Along with it all, of course, everyone wants the highest level of lighting for safety and fast production.

Westinghouse fluorescent lighting has proved top-value on all counts in thousands of commercial, industrial and institutional jobs. Ask your "Mr. PLUS" to show you the proof. DP-5034-D





Shown at right and above, Westinghouse Type LPB and RLM flourescent fixtures. Combining indirect and direct lighting, they provide high-level, evenly distributed light.
In the larger illustration, RLM type flourescent fixtures in the American Bakeries plant.

Wherever motors must "do it the hard way" install Westinghouse

In powering flour-handling equipment at the American Bakeries plant, the motor above illustrates better than a thousand words a big feature of Westinghouse power drives. This totally enclosed motor is good for years of dependable performance despite conditions that would choke an ordinary motor to death. Safe from explosion, too, if dust conditions become severe.

There are many other types of Westinghouse motors, for any kind of duty. Big point about all of them is their ability to "last forever" under severe conditions involving temperature, liquids, gas, dust or just plain hard work.

Write for motor data bulletin.

Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

DP-5034-E

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Buy everything electrical from MR. PLUS . . . your Westinghouse Distributor

In wire terminations

The world's finest silver bears a hallmark as proof of quality—the world's finest electrical product, which daily speeds and comforts your way of life, likewise bears a stamp of approval assuring the quality and reliability of its wire terminations.

In every piece of electrically powered equipment there are many points of potential failure—places where the wires forming the arterial network begin and end. These are the points, deep within the facade, where AMP quality and precision engineering is most appreciated.

A-MP solderless terminals and application tools have been designed and developed to meet the specific wiring requirements of electrical motivation, whenever and wherever it is generated, distributed, utilized or maintained.

Through speed and dependability of application, AMP solderless wiring techniques are now bringing to the industries of several continents the increased production volume so necessary in this age of automated manufacture.

A-MP terminals, when required for maintenance and repair needs, are made available in the U.S.A. through American Pamcor Inc.

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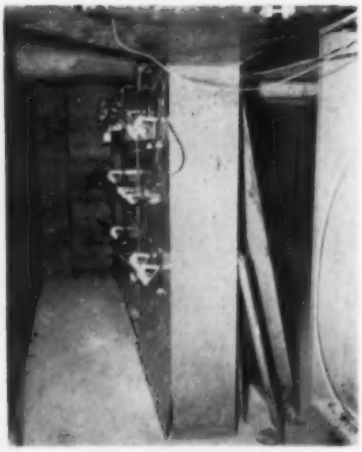


MAIN SWITCHBOARD in basement has 2,400-amp main breaker plus dead-front, fused disconnects for branch feeders serving multiple floors.

TRIANGULAR PULL BOX at the end of switchboard wire gutter accommodates riser conduits going up through multi-story building at electric closet locations.

floor. Individual apartments have their own branch circuit panels with range circuit.

Designed by Earl W. Morrison & Associates, architects and engineers, and installed by the Salmon Bay Electric Company, the 120/208-volt, 3-phase, 4-wire system begins at a main distribution center in the basement of the building. The dead-front switchboard contains a 2,400-amp main circuit breaker with associated metering equipment plus a series of fused, branch feeder disconnects ranging in size from 200 to 600 amps. Board construction features a main bus gutter at the base and a branch feeder gutter at the top terminating in a triangular pull box directly under the grouped-riser location.

In general, feeders to panels on

UL approved for direct cable burial, Rome's FlexAll makes it easy for you to keep the wiring out of sight.

How Rome's multi-purpose UF cable can help you "sell up" outdoor lighting

and get those extra wiring jobs that mean more profit

By "selling up" when contracting to wire a home, you can increase the amount of extra lighting you install—such as carriage lamps—and thereby boost your profits.

Rome's FlexAll—a nonmetallic sheathed UF cable—can help you get a larger number of outdoor residential lighting jobs. Low in price and easy to install, FlexAll reduces your installation costs and enables you to quote a more attractive price when "selling up" additional lighting.

Installs easily, lasts for years. FlexAll, when provided with overcurrent protection, is ideally suited for direct burial in the earth and its flexibility makes it easy to handle. Insulated with Rome Synthinol (polyvinyl chloride) thermoplastic compound, FlexAll provides exceptional resistance to the corrosive elements in the earth. In addition, it has high dielectric strength and excellent aging characteristics.

Helps you to "sell up." Merchandise your services, don't just make them available. Sell your customers on filling their future needs *now*. Get that extra wiring—lights for the barbecue pit—gate lights—carriage lamps—and *keep the wiring out of sight*. FlexAll permits you to put more wiring into many of your residential wiring jobs.

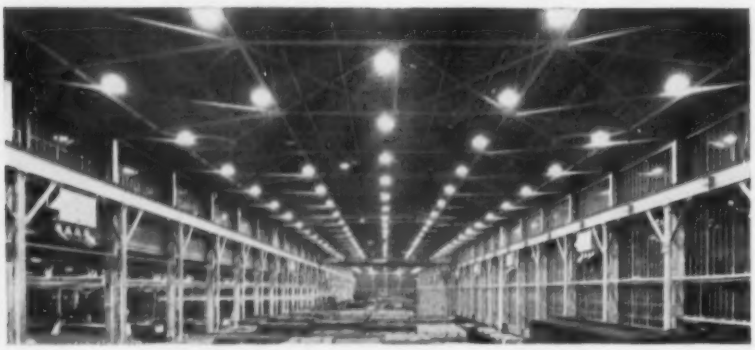
Specify Rome's FlexAll for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 346, Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

This...

instead of this



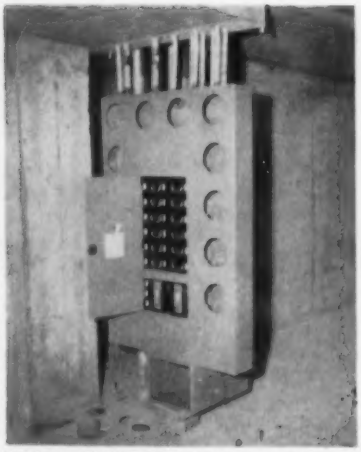
High bay lighting with Abolite is easier on the eyes

• In high bay lighting, Abolite open-top units eliminate uncomfortable contrast of bright lamps against dark background. 18% of the light is directed upward through Abolite's open top, washes out the deep shadows, gives lamps a soft background. 35° shielding of the lamp practically eliminates glare.

Open-top design also gives Abolite high bay units a self-cleaning action. Air circulates through the fixture, sweeps the reflecting surface clean, reduces lamp operating temperatures. As a result, lighting efficiency remains high, lamps last longer.

There are three Abolite uplight units for high bay lighting: 18" and 24" diameter Alzak fixtures for use with 400 and 1000 watt mercury lamps and 18" Alzak fixtures for 500 watt incandescent lamps (ideal for gymnasium lighting). For full details, write Abolite Lighting Division, The Jones Metal Products Co., West Lafayette, Ohio.

ABOLITE Lighting



FLOOR PANEL combines distribution center for apartment feeds plus submetering facilities in wide gutter space. Pull box at base encloses taps to multi-floor feeder. Electric closet enclosure was added later.

SMALL FLOOR PANEL has meter socket rings installed in gutter space. Four more were added to top gutter later.

each floor level consist of four 500MCM cables in 3½-in. conduit. Four such feeders rise through the building at the electric closet location. Each feeder serves four floors with one combination distribution and metering panel per floor. Protection for each riser is provided by a 400-amp switch, fused at cable capacity, in the main switchboard. Such multi-panel feeders pass through a special junction and splice box (16 in. by 16 in. by 20 in.) set flush with the face at the base of each floor panel. Panels on the first and second floors are each fed by four No. 4/0 cables in 2½-in. conduits.

With the exception of the first floor, there are 11 apartments per floor. Hence, the majority of floor panels have center sections with 12 60-amp, 2-pole, fused pull-out dis-

1. MID-SPAN TAPS help bring down the over-all cost of distribution with Rome's Triplex SD and secondary cable. You can tap between poles from either side, using conventional hardware plus a spreader block. Simple; fast; saves service wire. You save on pole cost, too—*as much as one-third*. With Rome's Triplex secondary you can span 300 feet from pole to pole. Use fewer poles; save time setting them; eliminate crossarms.

2. SAVE ON HARDWARE. Here's a comparison between the hardware needed to install one open-wire service drop (right)—using one pole—and Rome's aluminum Triplex equivalent (left) using a mid-span tap.

3. CUT MAN-HOURS on installation jobs. Triplex goes up much faster than open-wire service, because it requires less handling, less time installing hardware. It's easier to handle, too—aluminum cable assembly weighs less than conventional copper service wires.

If you take advantage of these important savings . . .

"Expensive" Triplex cables can cost less

Triplex sometimes *does* cost more than its open-wire equivalent.

But its on-line cost can be lower—*if you take advantage of the installation economies* that Triplex alone makes possible.

Fewer poles . . . less hardware . . . faster installation—these are the savings you make with Triplex. They can more than offset any extra cable cost.

In addition, there are many locations where you can improve service and reduce maintenance with Rome's aluminum Triplex. Wooded areas, for example—where Triplex *stays up* despite falling tree branches that might knock out open-wire secondaries. Residential streets, too—where good public relations indicates need for a neat, uncluttered installation.

Fits your modernization pattern

Introduced 10 years ago, Rome's Triplex SD Cable won almost immediate acceptance. As a next step in modernization, many utilities are now using lightweight aluminum Triplex for overhead secondaries as well. If you haven't yet adopted this practice, we invite you to look into the operating advantages—as well as the economies—that this Rome "package" concept offers you.

Specify Rome's aluminum Triplex for your next job. For more information, contact your nearest Rome Cable representative—or write to Department 368 and ask for descriptive Bulletin RCP-361. Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

NEVER A DOUBT WHEN THE PILOT LIGHT'S OUT!

Don't guess next time your control line pilot light goes out. Make sure you're using Westinghouse Push-to-Test* indicating lights.

A gentle touch tests the light instantly because an auxiliary set of contacts energizes the bulb. When the light flashes on, you know there is

trouble somewhere else in the circuit.

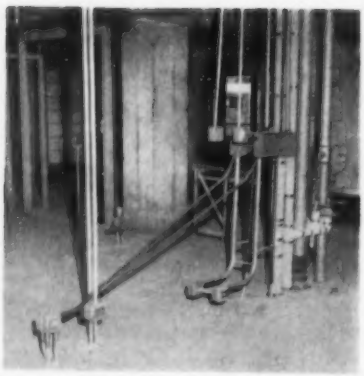
Shock-resistant, U. S. Navy-type lenses with wide-angle visibility assure the best performance. They are available in crystal, red, blue, amber, green and opalescent—frosted to eliminate false indications.

Push-to-Test lights are only one of many outstanding units in the Westinghouse Oil-Tite* pushbutton line. For further information, ask for the new booklet (B-7022) or the *Pushbutton Guide* (B-6749), a 72-page catalog illustrating the complete line. Write to Westinghouse, Box 868, Pittsburgh 30, Pa., or call your local Westinghouse distributor. *Trademark

J-30255

YOU CAN BE SURE...IF IT'S

Westinghouse



BACK-TO-BACK arrangement of individual apartment electric service centers. Kitchen wall encloses wiring.

connects (one spare) and a 200-amp, 3-pole, fused main disconnect. Wide gutter space around two sides and the top of the panel enclosure accommodate socket meters (four on each side and four across the top) to make a combination distribution and metering cabinet.

A majority of the apartments in the building are fed by three No. 6 conductors in 1-in. conduit originating at the meter panel and terminating in an individual apartment branch circuit panel located in the kitchen. Most of these distribution centers contain four branches plus a range circuit. Larger apartments (two per floor) have six branches plus the range circuit.

MICHAEL ZALESKE, experienced plant superintendent in charge of manufacturing operations for Automatic Switch Company who is currently bringing his versatile engineering talents to bear on machine layout and electrical distribution inside the company's new, modern plant at Florham Park, N. J., here checks the automatic emergency transfer switch in the new plant.

ALL HE'S CHECKING IS WHAT'S ON THE REELS —NOT THE REELS THEMSELVES. These convenient one-way reels are now available with Rome's building wire, Triplex SD, and line wire.

There's no need to keep track of these one-way reels . . . they're non-returnable

Now available in all bldg. wire through 500 MCM, Triplex SD, and line wire

The non-returnable reel—first adopted as a standard by Rome Cable—gets rid of many of your recording, reshipping, and inventory headaches. Here are some of the ways it benefits you:

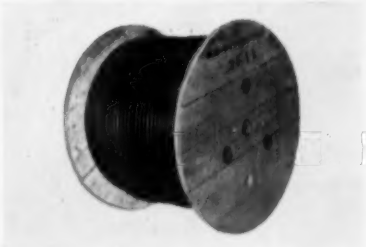
Eliminates bookkeeping costs. You avoid the extra paper work brought on by billing, crediting, and storing of returnable reels.

Saves storage space. When the wire or cable is used up, you simply destroy the reel or throw it away.

Handles easier. Rome's non-returnable reel is lighter to handle than an ordinary reel—yet sturdy and quite adequate for normal service.

All these benefits are now available to you with all Rome's building wire through 500MCM, Triplex service drop cable, and line wire.

Be sure to consider the advantages of Rome's standard non-returnable reel package when you place your next wire or cable order. Contact your nearest Rome Cable representative for more information—or write to Dept. 139, Rome Cable Corporation, Rome, N. Y.



ROME CABLE

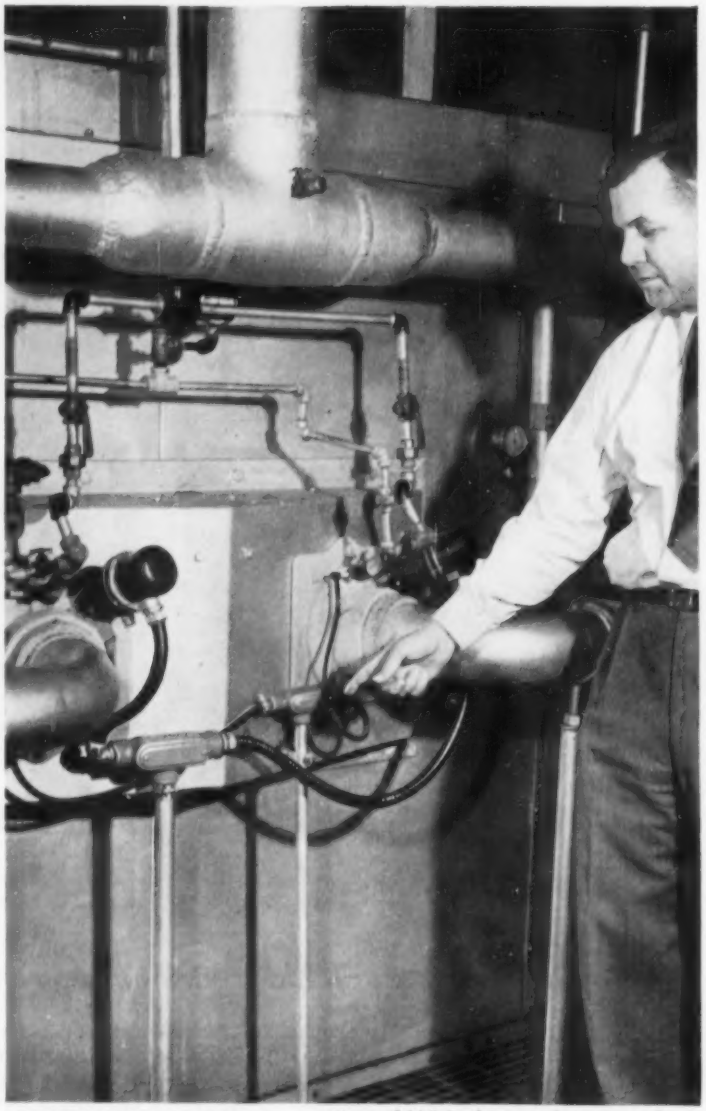
CORPORATION

In Firestone Textiles mill— conduit beats wet, hot and

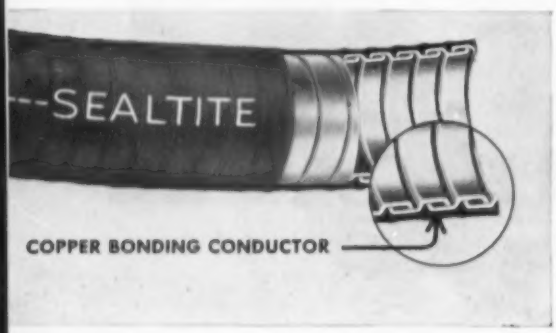
Sealtite* flexible, liquid-tight conduit was made to handle trouble. Oil and grease. Weather, water and dirt. Chemicals, corrosive fumes and salt spray. Its tough plastic vinyl jacket resists conditions that corrode and knock out ordinary metal conduit. Wiring can't be damaged. Protection is complete.

Firestone Textiles, Gastonia, N. C., finds Sealtite has still another money-saving advantage. In the time it takes to bend rigid conduit to shape, flexible Sealtite is in and the electrician is out—ready for another job. The speed and ease of installing Sealtite — especially in close quarters — reduces installation costs and machine down time.

WANT TO KNOW MORE? Electrical Wholesalers stock Types U.A. and E.F.† Sealtite in easy-to-handle coils. Be certain you ask for and get the quality conduit marked "Sealtite" on the cover. Buy it in long lengths and cut it on the job without waste. Special liquid-tight connectors are available from leading manufacturers. Free booklet S-537 gives you full information on Sealtite. For your copy, write: The American Brass Company, American Metal Hose Division, Waterbury 20, Conn. In Canada, Sealtite is approved by Canadian Standards Association, and sold by Anaconda American Brass Ltd., New Toronto, Ont. *Trademark †Pat. Applied For 57194



ON CORD DIPPING MACHINE, two sections of ½" Sealtite conduit run to direct fire gas burner. Conduit is subject to 150° heat, plus vibration.

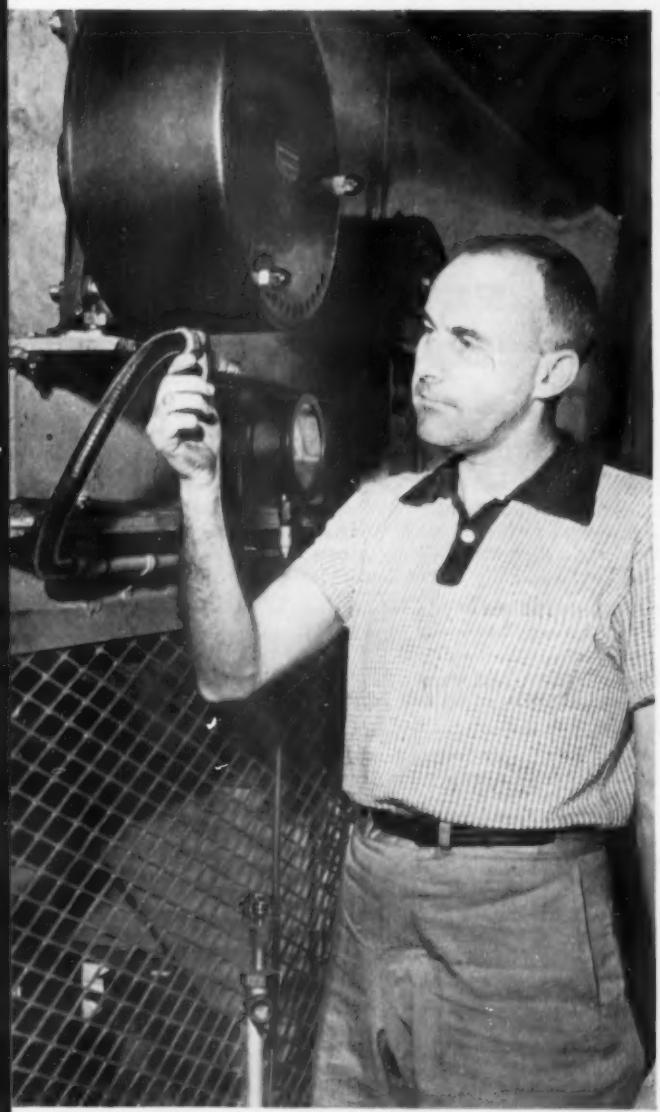


CUTAWAY of Type U.A. Sealtite shows tough polyvinyl chloride jacket over flexible metal core. Copper conductor wound spirally inside conduit provides positive ground.

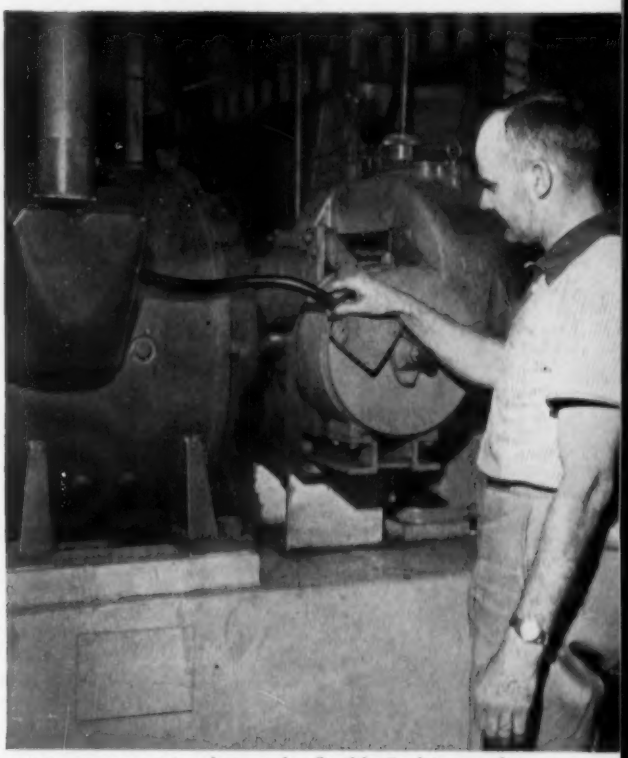
Insist on the conduit marked

SEALTITE

Sealtite flexible, liquid-tight corrosive atmospheres

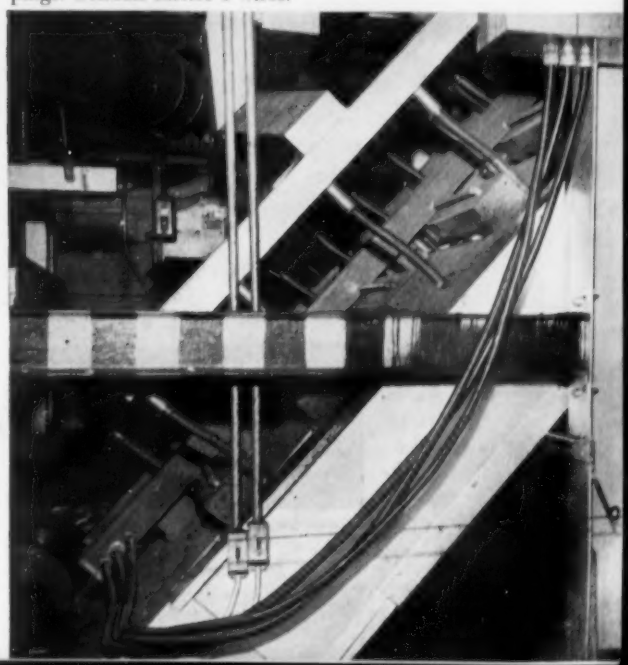


OVER DIP VAT, Sealtite resists chemical fumes at Firestone Textiles. This conduit has been in use for over three years.



HEAVY VIBRATION is taken up by flexible Sealtite conduit running from 50 HP motor. Equipment runs 24 hours a day, 5 days a week. No failures with Sealtite!

3-WAY ATTACK is made on Sealtite conduit running to infrared lamp installation: heat, chemical fumes, and chemical drippings. Conduit carries 3 wires.



an **ANACONDA**® *product*

Your customers may need this drive...

TO AUTOMATE YOUR MOTOR DRIVEN PRODUCTS...
GIVE THEM PRECISE, VARIABLE SPEED CONTROL...

Century Performance-Rated®

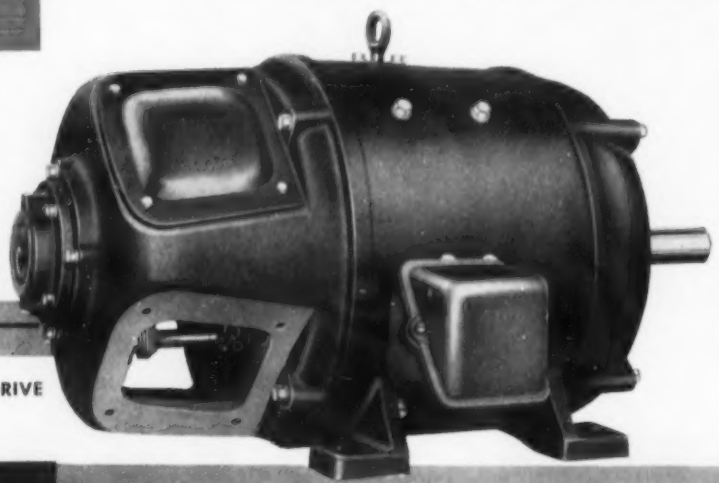
SELECTIVE SPEED DRIVE

How many of your customers could use the *full* potential of your product when given automatic operation by a Century Selective Speed Drive? Possibly more than you think.

Here's why. Predetermined, *automatic* manufacturing operations are faster, more accurate than manually controlled operations. A Century Selective Speed Drive on your product will respond to changes in operations—such as varying temperature, pressure, size, viscosity—and *automatically* adjust motor speed to fit the job.

Operating from AC, these drives offer a broad range of DC stepless speed control. They can regulate speed for individual drives or for precision interlocked multi-motor drives . . . can be used for jogging, normal or fast starts and stops, forward or reversing . . . and respond to a wide variety of remote control devices.

Century has more than 50 years' experience in engineering DC motors. For information on any motor application, call or write your nearby Century District Sales Office or Authorized Distributor.



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Performance-Rated® MOTORS
1/20 to 400 H.P.

CENTURY ELECTRIC COMPANY

1806 Pine Street • St. Louis 3, Missouri • *Offices and Stock Points in Principal Cities*

Motor Shops

Efficiency—Key to Greater Profits

Greater efficiency in the electric motor repair shop of Milton Eisenhardt, Pennsauken, N. J., has resulted in increased productivity with the same amount of labor, bringing about an increase in revenue.

"The way to greater profits is through increased productivity, but not at the expense of 'pushing' the labor element," explains the treasurer of the Quaker City chapter of NISA. "Motor repair mechanics can do just so much in a given time. The way to greater productivity therefore, is through better shop efficiency — a path that will permit greater work effort in the same work period."

For example, all burn-out work and tearing down of assemblies is handled by an employee during the evening hours — from 6 P.M. to 10 P.M. The four full-fledged motor repair mechanics therefore, can be ready to start work upon arrival at the shop. And inasmuch as these mechanics are the highest paid, they are only concerned with the major operations.

"Previously, they also did the burn-out work and tearing down of assemblies," explains Eisenhardt, "which meant that they were drawing high skill pay for minor work functions. This also slowed down the time spent on actual motor repairs. Now however, we pay a minimum labor rate for these minor operations and the mechanics are ready for the more technical operations during their average work day."

INFORMATION CENTER of shop is section in which all types of catalog data, prices and inventory data are concentrated to permit ready, accurate checking and cross-checking on job needs.

Similarly, completed motors are sprayed, cleaned and baked during the same evening hours at the minimum labor cost. In this way, the greatest productivity is had for the lowest rate of labor payment.

A complete set of catalogs as well as a complete inventory sheet of parts and supplies in stock has also helped to cut down "lost-time" in the shop. Counter trade, telephone inquiries and other demands upon shop labor has been reduced because of these complete records. Reference is fast and little time lost in obtaining prices, data and checking on items in stock when required in the course of a day.

"We have concentrated all this information at one point so that anyone in our shop can find anything required in a minimum of time and without having to ask others or hunt for it," says Eisenhardt. "We figure that this information saves at least two working hours daily or from 10 to 12 hours weekly. Multiply this by our skilled labor cost and its easy to see the savings."

Easily and clearly identifying supplies, parts and fittings so that mechanics lose little time in securing exactly what is needed, has also been a helpful time saver. A series of steel shelving units are used as a storage for small cardboard cartons that contain the repair shop inventory. Each of these cartons are clearly identified by name and stock number. The wholesale and retail price of each item is also noted on the cartons so that when this is needed, the mechanic can

SMALL PARTS are stocked on shelves in cartons that are clearly identified with spec data, stock numbers and pricing information—assuring quick, positive selection of small parts and fittings by mechanics.

COIL STRIPPING of motor—tearing down and burning out of coils—and dipping and baking of rewound motors are handled during evening hours at lower wage rates. Motors are prepared for work by highly skilled mechanics during regular hours.

New lightweight GREENLEE No. 884 bends up to 4" conduit as much as 90° with one fast ram stroke

One man wheels it from job to job . . . on its specially designed pipe supports!

Universal pipe supports, positive locking pin . . . many other advanced features.

Speed conduit installations, cut costs with this time-saving GREENLEE tool. New, advanced design to meet your needs for a lighter weight, faster, easier portable, easier operated hydraulic bender for conduit of ½" through 4" sizes.

Full 90-degree bend is made with one ram stroke of this advanced new tool in just 4 minutes with GREENLEE Power Pump shown above! Combined with the faster No. 797-E-SA Power Pump for production work, new bender actually bends 4-inch conduit 90° in only 30 seconds! Precise smaller bends of any degree are facilitated by scale on side of ram.

High-strength aluminum alloy is combined with high-alloy steel for ideal structural combination of ruggedness and light weight. Bender develops 40 tons of ram pressure; yet one man easily transports, sets up, and operates it.

A dozen advanced features put the 884 in a class by itself for easier portability, versatility, simple setup, easy operation, and ideal job or production speeds of bending. For instance, universal pipe supports, simply rotated to handle 10 conduit sizes, also facilitate easy insertion and removal of conduit from *front* of bender.

Meets wide range of bending needs: bends ½-in., ¾-in., 1-in., 1¼-in., 1½-in., 2-in., 2½-in., 3-in., 3½-in., and 4-in. pipe and rigid conduit.

Ask the GREENLEE Canadian representative or write for new illustrated Bulletin, E-224, giving full details and specifications.

TOOLS FOR CRAFTSMEN
GREENLEE

GREENLEE TOOL CO., 1748 **Columbia Ave., Rockford, Illinois**

quickly secure it. This makes it easy for the mechanic to price the materials going into a job. At the end of the job, the time spent is noted, and the bill for materials and labor is easily and quickly computed.

Periodically, this shop uses direct mail and stuffers in all statement envelopes to keep the firm's name before customers and prospects. A survey made by Eisenhardt showed him that he attracted three new customers for every $10 invested in direct mail. And he conducts this campaign two or three times a year as the need for new business arises.

"We know the limitations of our shop and always endeavour to keep it at this maximum point," explains Eisenhardt. "Expansion is limited because of space requirements and because we know there are 'peak-and-valley' periods and the best way to operate a shop at best income level, is to maintain a constant peak productivity. And this is our intention."

Coil Puller For Stubborn Jobs

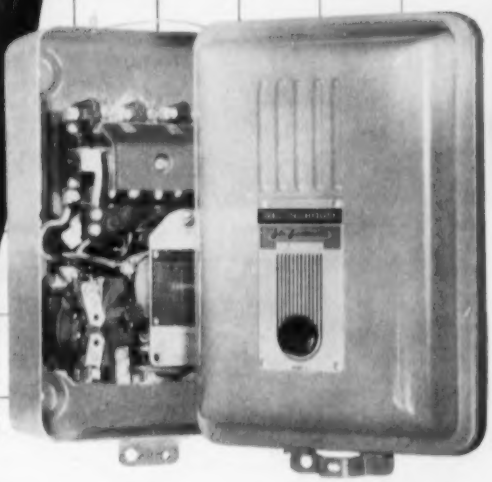
A special, shop-made, coil ripping rig is often used to pull stubborn windings out of stators in the electric motor repair shop of Central Armature Works, Inc., Washington, D. C. The rig greatly simplifies and speeds up the removal of old windings prior to rewiring.

COIL PULLER is shop-made rig which includes a vise-assembly to hold the stator, a clamp and chain arrangement to grip the coil ends, and a sprocket and handle arrangement to exert pull on the chain.

MORE HORSEPOWER!

LESS COST!

SMALLER SPACE!



with Westinghouse rerated motor starters

Here's real news for cost-conscious, space-conscious electrical planners.

Westinghouse Life-Linestarters® (sizes 0 and 1) *have been uprated* . . . giving you the advantages of more horsepower, less space, lower cost!

For example: if you've been controlling a 440-volt, 5-hp polyphase motor with a size 1 starter, you can get the identical control and protection with the smaller, less costly size 0 starter.

And speaking of performance . . .

Only Westinghouse starters have the De-ion® arc quencher, which greatly increases contact life by reducing burning and pitting.

Westinghouse starters utilize high-strength, non-carbonizing Rosite insulating parts for maximum safety and operating life.

Westinghouse starters have double-break, silver-to-silver contacts for longer life and greater dependability.

What's more, the entire starter line is designed to simplify installation and maintenance — featuring front-removable parts and straight-through wiring.

For the full story, contact your nearby Westinghouse sales office. Or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Penna. J-30280

NEMA SIZE	110 Volt				220 Volt				440-600 Volt			
	1ø		3ø		1ø		3ø		1ø		3ø	
	Old Rating	New Rating	Old Rating	New Rating	Old Rating	New Rating	Old Rating	New Rating	Old Rating	New Rating	Old Rating	New Rating
0	1	1	1½	2	1½	2	2	3	1½	3	3	5
1	1½	2	3	3	3	3	5	7½	5	5	7½	10

Westinghouse uprated starters give you: More horsepower — in eight new starter ratings. Less cost and space — in applications where the rerated size 0 starter replaces the size 1 starter, and the size 1 replaces the size 2.

YOU CAN BE SURE... IF IT'S Westinghouse

ALUMINUM
OR GALVANIZED STEEL
SUPPORT SYSTEMS
FOR POWER AND CONTROL CABLES
IN-FREE-AIR
DESIGNED AND DEVELOPED BY HUSKY PRODUCTS

Mr. Engineer...

Mr. Contractor...

HUSKY
CABLE SUPPORT SYSTEMS
are NOT ONLY
RECOMMENDED and APPROVED
by ALL Leading
CABLE MANUFACTURERS
They are actually SOLD by
MOST of the large cable
manufacturers.

NO OTHER
POWER CABLE SUPPORT
SYSTEM HAS THIS DISTINCTION.

DO YOU KNOW WHY??

The only "electrically sound" system; let us explain...
or...ask your cable manufacturers representative.

ALSO...
Send for your copy of the story of
"CABLE IN-FREE-AIR"

AVAILABLE THROUGH LEADING CABLE MANUFACTURERS

HUSKY PRODUCTS, INC.
5300 VINE STREET, CINCINNATI 17, OHIO

As shown, the overall assembly of the coil puller consists of a channel iron base, a vise-like assembly to hold the work, and an upright chain pulling arrangement. The rig is used as follows: the stator to be cleaned is placed in the angle-iron vise which has three clamp arms to hold any size of armature. The holding arms are kept in place by simple thumb screws. The vise assembly consists of a short section of pipe with slotted lengths of angle-iron welded in the horizontal position to the pipe stub and braced. The clamp arms of the vise assembly are supported in the slotted angle iron.

A clamp on the end of a cable chain is hooked onto the winding of the stator. This clamp is welded to the end of the cable chain, which runs up and over a sprocket assembly, mounted on top of a pipe stand. The sprocket assembly is hand powered to exert pull on the chain. A four-handle lever wheel is used for this. Turning the wheel pulls the chain.

As shown in the photo, the mechanic using the rig hooks the clamp to the coils and with continuing pressure rips out the stubborn coils. He repeats the operation as often as needed on one side, then turns the stator over and repeats the operation on the other side. Each time he connects the coil puller to a group of wires. Removing the remaining wire is then an easy chore.

SHOW WINDOW REPAIR—In the shop at Meyers Electric Motor Repair, Bordentown, N. J., mechanics work on benches in full and clear view of of all customers to add a touch of showmanship to the operation. Here Floyd L. Meyers does some stator work while a customer looks on. By letting the customers see all, Meyers has found, the customer realizes that expert motor repair can only be handled in a fully equipped, modern motor shop. Further, the customer comes to recognize the extensive detail work associated with such work and to appreciate costs involved.

Okolite-Okoprene aerial cables furnish a low-cost route for increased power demands over a span of 420 feet between buildings.

More power the low cost way ...with Okolite-Okoprene aerial cable

To meet the power demands of increased cigarette production, The R. J. Reynolds Tobacco Company of Winston-Salem, North Carolina, recently installed the two Okolite-Okoprene aerial cables shown here. An operating voltage of 15kv and a span of 420 feet across two open primary lines and railroad sidings called for aerial cables with maximum reliability. Okolite-Okoprene self-supporting cable was used, with extra messenger for added safety.

Here is another case where an Okonite self-supporting aerial cable solved an increased power-demand problem simply and economically. The overhead route often costs much less than the underground route . . . and it can be just as safe, too, when you use dependable Okolite-Okoprene cable. Recommended for general use up to 35kv, Okolite-Okoprene is insulated by Okonite's exclusive strip process and (if rated at over 2kv) inspected inch-by-inch on the Gooding Test Train.

Okonite is the only manufacturer making cables by all insulating methods: strip, extrusion, tape or dip. Thus we are in the unique position of being able to recommend to you without prejudice the one cable which most closely meets your requirements. The Okonite Company, Passaic, New Jersey.

where there's electrical power . . . there's **OKONITE CABLE**

4899

Killark goes to the

for a first-hand report on the

A KILLARK JOB LASTS AND LASTS. A contractor wants to be proud of the job he does. If there's anything that hurts, it's to have to come back to a job a few years later and find it half eaten away by the ravages of time and weather. There's *never* such a problem with a Killark Electrolet on the job — because aluminum does not rust or corrode.

Killark

K KILLARK ST. LOUIS

ELECTRIC MANUFACTURING COMPANY

ELECTROLET KILLARK ALUMALET

Vandeventer and Easton Aves. St. Louis 13, Missouri

"Man on the Ladder"
advantages of KILLARK fittings

I was talking to one of the folks from Killark the other day, when he said to me, "You know, we've been telling contractors about our Killark fittings for a long time – but as any manufacturer would, as *we* see them.

"Seems to me," he continued, "the real person to tell about our fittings is the man who actually installs them – 'the man on the ladder.'"

Now that makes sense to me. If anybody knows the problems and pleasures of installation, that person would be the fellow who has to climb up the ladder, with wrench in hand, and *install* these fittings! And because I've been installing Killark Alumalet fittings for almost as many years as they've been making them, I've been asked to tell you about some of the things I've discovered, and learned to expect from a Killark installation.

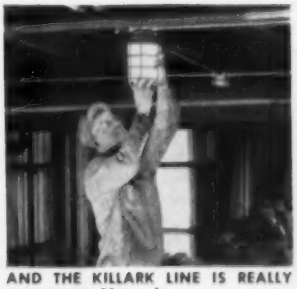
. . . The More I Install,
The More I Insist
on KILLARK QUALITY!

WHY DON'T YOU TRY KILLARK ON YOUR NEXT JOB?

KILLARK FITTINGS OFFER 3-WAY STRENGTH. Don't let the word "aluminum" fool you. Killark fittings are not only durable, they can take it. I took a trip through the Killark foundry recently and they showed me how these fittings are die-cast from a special alloy under 10,000 lbs. of pressure. They tell me this produces a tougher, closer-grained metal. I don't know about such things, but I do know in my first-hand experience of putting a tool to these fittings that they can stand shock and strain far beyond any on-the-job requirements.

EVEN THE "BIG ONES" ARE EASY TO INSTALL! Ask any contractor who's out on the wiring line day after day – he'll tell you how much he appreciates the lightweight and the strength of Killark's Alumalloy construction. Take a look at the whopper I'm holding here at arm's length. Try this some time with an iron fitting!

I LIKE KILLARK'S EASY-MAINTENANCE DESIGN, TOO! You don't have to reconstruct, in order to relamp a Killark fixture. Twist a couple of screws, change the bulb, replace the glass – that's all! It's typical of the simple, sensible design in all Killark fittings and fixtures, like, for example, the roomier splicing areas in all Killark Electrolets.



AND THE KILLARK LINE IS REALLY COMPLETE. Haven't come across a job yet where there wasn't a Killark fitting designed to handle it. This warehouse is being safely lighted with a Killark vapor-tight fixture. Moisture or humidity won't ever bother it.

KILLARK SPEEDOLETS ARE FASTER AND EASIER TO INSTALL. Take the feature on this Speedolet entrance fitting I'm installing here. I just slipped it over the conduit, tightened two screws, and the job was done! No threads to cut, no wrench – just a screwdriver. Killark is always coming up with something like this to save us fellows on the ladders a little more time and work, and we sure appreciate it. Have you seen these new Speedolet conduit bodies? They're Tops.

SALES OFFICES and WAREHOUSE STOCKS	Atlanta	69 Mills St., N. W.	Dallas	1901 Griffin St.	Philadelphia	2014 Chancellor St.
	Boston	49-51 D St.	Denver	1073 Galapago	Pittsburgh	4830 McKnight Road
	Buffalo	278 Johnson St.	Detroit	8319 Mack Ave.	San Francisco	714 Harrison St.
	Chicago	1528 West Adams St.				
	Cincinnati	1031 Meta Dr.	Los Angeles	412 Seaton St.	Seattle	4130 First Ave., So.
SALES OFFICES	Baltimore	11 W. 25th St.	Kansas City, Mo.	616 W. 26th St.	New York	600 W. 181st St.
	Columbus	390 McCoy St.	Minneapolis	826 Andrus Bldg.		

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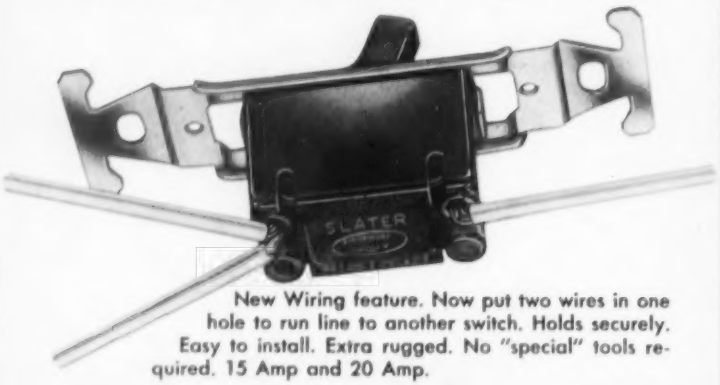
NEW Slater 600 QUIET SWITCH

- **Two Wires in Each Hole**
- **Patented Side Release** *(Pat. No. 2,795,677)*



New Wiring feature. Now put two wires in one hole to run line to another switch. Holds securely. Easy to install. Extra rugged. No "special" tools required. 15 Amp and 20 Amp.

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SLATER ELECTRIC & MFG. CO., INC.
45 SEA CLIFF AVENUE
GLEN COVE • NEW YORK

Slater

NEW Slater 800 RECEPTACLE

- **Extra Rugged**
- **Speed Wire** *(Rear Wiring)*
- **Patented Side Release** *(Pat. No. 2,795,677)*

This new screwless-type receptacle is a real time-saver. Holds 12 and 14 wires tight. Does not spread contacts. No "special" tools required at any time. 15 Amperes.

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Slater

COMMON CODE PROBLEM

[FROM PAGE 87]

no main fuse, the service conductors would be over-fused 108%.

I mention this point to emphasize the fact that the current through the service entrance conductors will be limited to the conductor rating, only when the overcurrent device is fixed at its maximum rating and is the same as the conductor rating. While the Code does not so require, some inspection authorities would require, in the case presented by Fig. No. 2, that the service conductors be rated 200 amps which would result in a 3/0 RH service.

The only other objection to service entrance assemblies, without a main switch and overcurrent device, particularly in residential occupancies, concerns the confusion in the minds of many householders as to what action is essential to disconnect all of the wiring and equipment in his property. Wiring diagrams are provided but they are meaningless to the uninformed. A disconnect marked "main" which only controls the lighting circuits may create a false impression in the minds of some people. When six service disconnects are installed in a service assembly, all are main disconnects, and I believe this point could be more clearly indicated on the wiring diagram by simple phraseology understandable to all.

Regardless of the above objections to multiple service assemblies, I believe that field experience indicates no occasion to change the present Code provisions. As a minimum requirement, it has proved to offer the practicable safety required by the Code. The installation of one main disconnect undoubtedly has advantages which are desired by some but to many others are not considered to be so significant.

Another correspondent cites an example similar to the one shown by Fig. No. 3. He questions the provisions of Section 2351-b covering multiple occupancy buildings on the basis that the current which may enter the property over a given size of service is not limited, within any reasonable degree, to the size of the main service entrance conductors.

It appears evident from the example shown by Fig. No. 3 that the 150-amp service entrance conductors could be subjected to a current of 720 amps. While I do not wish to suggest that this is probable, it is quite evident that they could readily become considerably overloaded. It is also interesting to note, if the building in question is not more than two stories in height, we could have as many sets of service equipment as there were apartments. Instead of six as shown, there could be 10, 40, or more.

The six sub-sets of service entrance conductors have a total current capacity of 390 amps, 260% greater than the main conductors. While the example only shows two disconnects per apartment, there could be as many as six, for a total of 36. It is also of interest to note the amount of unprotected service entrance conductors involved with this Code rule. Instead of the usual 10 or 15 ft, we may have 100 ft or more of uncontrolled conductors, protected solely by the primary overcurrent device. I mention these various factors since they involve questionable procedures, more significant than those presented by the single occupancy building, or the single family dwelling where six service disconnects are installed in one enclosure approved by UL for service use. I personally believe, so long as such procedure is recognized by the Code, that the questions raised concerning single occupancy services become minor.

It is also interesting to note how the applicable demand factors influence the size of the mains as the number of apartments increase, and also how the amperes per apartment, in the main service continues to decrease. Starting with the example shown of six apartments, the main service conductors are required to have a current capacity of 141 amps. This allows 23.5 amps per apartment which has a demand load of 50 amps and a total connected load of 72 amps. As the number of apartments similarly wired increase, the values are:

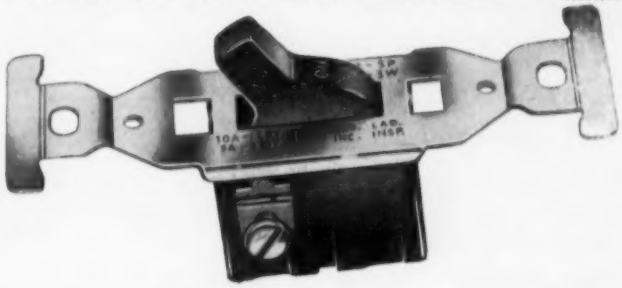
No. Apts.	Demand Watts	Main Amps	Amps/ Apt.
6	32,400	141	23.5
10	42,700	186	18.6
20	68,450	297	14.8
40	119,950	521	13.0

In view of our increased tempo for electrical living, demand factors should be reviewed on the basis of present day conditions.

Slater 400
TOGGLE SWITCH

- 10 Amp.-"T" Rated
- Specification Grade
- Exclusive Baff-L-ator Mechanism

Pat. No. 2,688,057



New improved model of one of our best sellers. Extremely sturdy and dependable. Baff-l-ator prevents contact bounce, reduces arcing and pitting.

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Slater 300
DUPLEX RECEPTACLE

HEAVY DUTY "T" SLOT

This specification grade, heavy-duty receptacle is still the old favorite with electrical contractors. It's rugged, dependable and easy to install.

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quick answers

to cable splicing problems

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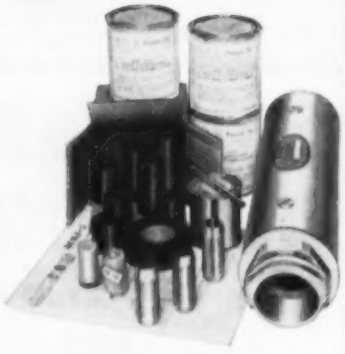
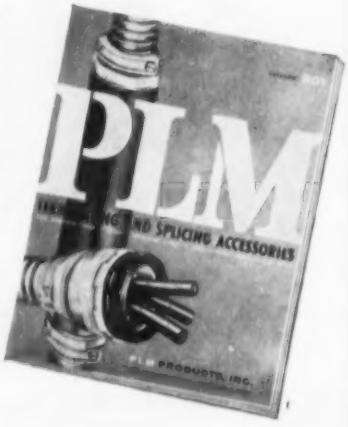
PLM

SPLICING BOXES AND KITS

● No need for detailed designing, specifying and ordering of materials for cable joints! PLM provides quick answers in PLM Unit Package Splicing Kits, complete with casings for 2, 3 or 4-way joints, all materials needed, and detailed installation instructions. You specify cable sizes and ratings, or order from new, 52-page PLM Catalog 301.

Casings supplied in cast aluminum or bronze, in ratings through 23 kv, for joints in or to armored cable. Other unit package splicing kits for non-metallic sheathed and lead-covered cable. Write for Catalog 301 or ask for prices on your needs.





New PLM Catalog 301 includes dimensions and shipping weights, as well as prices, for planning cable installations. Catalog also includes PLM Terminators and Terminating Kits.

PLM PRODUCTS, INC. · 3875 West 150th Street · Cleveland 11, Ohio
WIRE AND CABLE FITTINGS AND ACCESSORIES

WHAT'S THE LAW?

By Jack & Michael Strauss

QUESTION: Can a union compel enforcement of an owner-general contractor agreement to use union workers only?

Mr. Dinkelhoffer hired a general contractor to build an extension to his already massive factory building. Under the terms of their agreement, the general contractor was specifically required to employ only union labor in completing the work.

"If the general contractor fails to use union labor exclusively . . . and the general contractor thereby becomes involed in labor difficulties", the agreement stated, "the owner may terminate the agreement."

As the head of the building project, it was only natural that the general contractor should have headaches. The first arose when his electrical sub-contractor employed nonunion electrical workers. The local electrical construction workers' union raced to court yelling "FOUL!" . . . and demanding that the general contractor be ordered to abide by his agreement to use union help only.

"The union isn't a party to my contract", the general contractor protested in court. "What right have they got to insist that I be made to abide by it?"

"An obvious right", retorted a union representative. "The purpose of the union clause in his contract with the owner was intended for the benefit and protection of unionized workers. As the representative of unionized electrical workers, we have a right to intercede for their benefit."

THIS WAS THE DECISION: The Court ruled against the union. It held, in effect, that if the contract was intended to benefit a third party . . . the electrical union, in this case . . . the electrical union would have a right to compel its enforcement. But, despite the indirect benefit to the electrical union, the court found that the "union labor" clause was designed clearly for the benefit of the owner . . . to avoid labor disputes . . . and not for the protection of members of a union.

(Based upon a December, 1955, Pennsylvania Decision. State laws vary. For personal guidance, see your local attorney.)

Speeds through brittle fibre pipe slick as a whistle!

Rugged B&D Heavy-Duty Jig Saw zips through jobs!

POWER-BUILT design to make your installations easier!

Designed for the toughest jobs, the versatile Black & Decker Heavy-Duty Jig Saw is powered to save you muscle and manhours. Combines a sabre, rip, crosscut, coping, hand, hack and keyhole saw in one hand-fitting tool. Makes curved, straight or irregular cuts—pocket cuts in floors, baseboards and panels. Full 1″ stroke . . . cuts to a 45° angle on either side.

Heavy-Duty, B&D-built motor won't stall, runs cool, without vibration. Heavy-duty shoe won't wobble or distort. See your B&D distributor for a free demonstration—you'll wonder how you ever did without one! Or, for full details, write: THE BLACK & DECKER MFG. CO., Dept. 1208, Towson 4, Maryland. (In Canada: P. O. Box 278, Brockville, Ont.)

Look Under "TOOLS-ELECTRIC" in Yellow Pages

Leading Distributors Everywhere Sell

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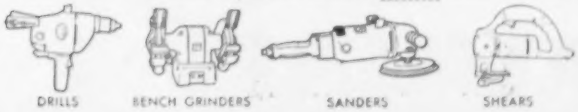
Quality Electric Tools—Power-Built to Last



Slices through sheet metal like a knife through butter.

Cuts neat, clean holes in wood: 1″ hardwood; 2″ in soft.

Makes pocket cuts quick and easy.

Swifty Service says: Give your B&D Tools local B&D Factory Branch *Service*.

CHECK HIDDEN FEATURES of Allis-Chalmers Individually Enclosed

LOW VOLTAGE BREAKERS

Safe, Easy to Inspect . . . Simple, Easy to Mount

1. Easily accessible — Removal of deep front cover permits inspection and maintenance of breaker from front or sides.

2. Easy breaker removal — Pull-out construction permits removal without disconnecting cables. Cable connections are accessible through entire front opening.

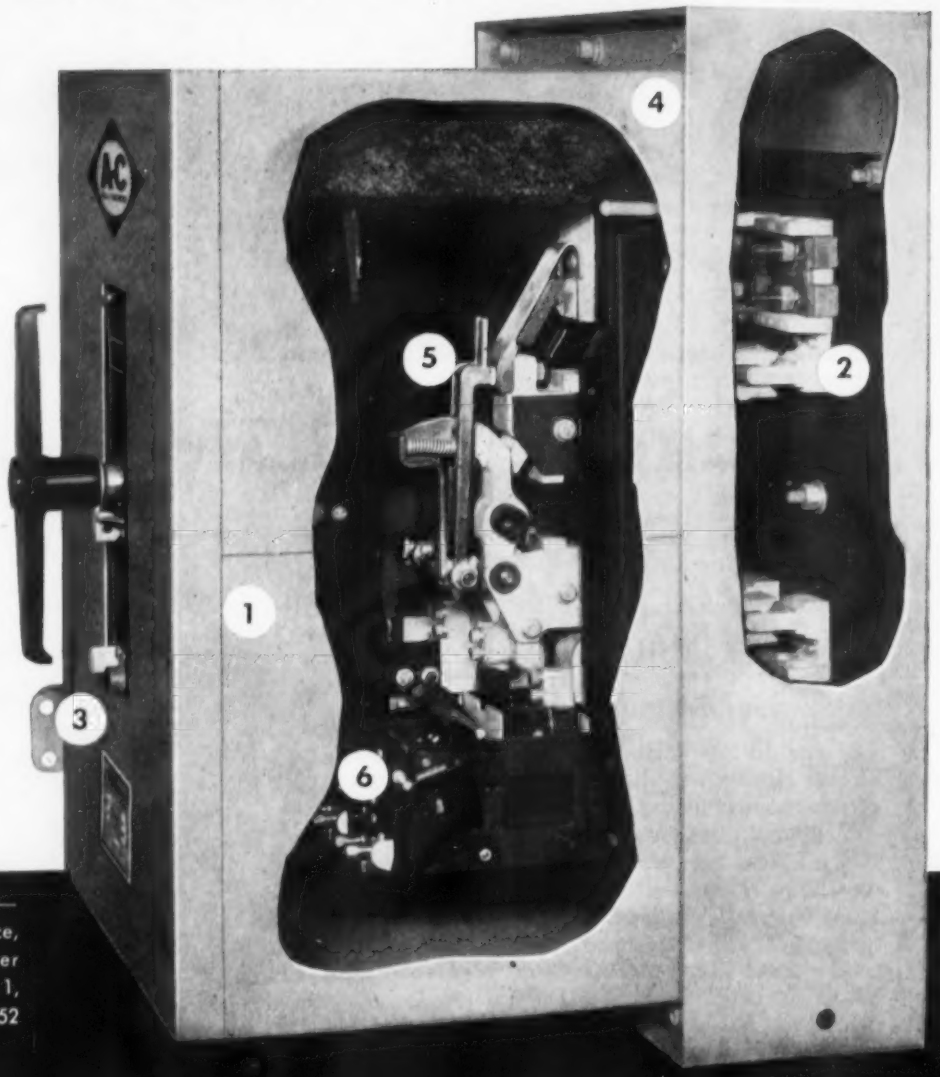
3. Safety Interlock — Prevents removal of cover while breaker contacts are closed.

4. Enclosures to meet your needs — Weather-proof or dust-proof as well as standard general purpose enclosures are available.

5. Long life contacts — There's no bounce—less erosion — due to high contact pressure with blow-on type action.

6. Accurate time-delay control — Hermetically sealed, positive displacement trip device is used.

For service to 600 volts ac, 1600 amperes continuous, 50,000 RMS amperes interrupting at 600 volts ac.



Get details, dimensions, prices — Contact your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin, for Bulletins 18B8252 and 18B8283.

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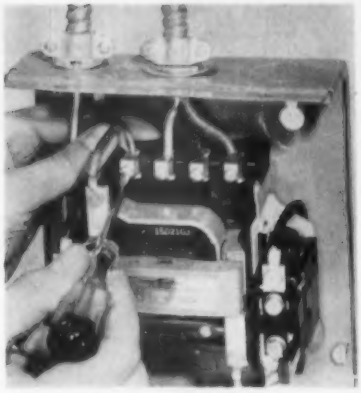
Product News



Size 0 & 1 Magnetic Motor Starters (1)

A NEMA Size 0 and 1 magnetic motor starter that is 42% smaller than previous open forms, has been developed for such applications as machine tools, pumps, hoists, blowers, saws, compressors, mixers, and packaging machinery.

The new starter is of "snap-slide" construction. Principal components snap or slide together for quick inspection and maintenance.

By turning a knob on each of the two overload relays, the overload trip setting can be adjusted up to plus or minus 15% of nominal heater rating. This permits quick adjustment to meet special application requirements such as in areas with varying temperatures.

A new coil that requires a lower inrush current permits a reduction in cost and mounting space requirements for a control transformer. The improved coil makes possible the use of a 47% lower rated transformer than with previous starters.

The new starter can be mounted in any position. The coil is removed from the front. Starters can be mounted closer together on a panel.

All wiring on the magnetic starter, including work on interlocks and overload relays, can be done from in front of the unit. Even though the starter is smaller than previous units, the new enclosure has 32% more wiring space. Removable sides come off easily, providing even greater wiring space. The enclosure has a total of ten combination knockouts for wiring convenience.

General Electric Co., Schenectady 5, N. Y.

Induction Motor (2)

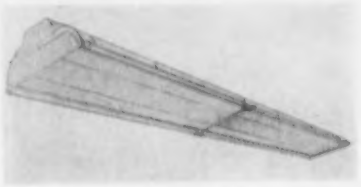
A new capacitor-transformer type of single-phase induction motor has no centrifugal switches, relays, brushes or arcing parts; operates on a new patented circuit embodying inductive theory and resonance principle. Motor starting winding and electrolytic capacitor are permanently connected in series in the secondary circuit of a current transformer. Primary of transformer is connected in series with the motor running winding and to an alternating current source. Unit develops high starting torque with low line starting current consumption. Motor is ideal for hazardous locations; adaptable to heavy duty or moderate starting loads and intermittent overload surge applications. Available in dual-voltage (115-230-volt) ratings from ½ to 2 hp size with transformer enclosure either on side or top of motor frame.

Lewus Electric Company, 1254 West Harrison St., Chicago 7, Ill.

Floor Box (3)

Floor box-receptacle combination provides flexible outlet for greater convenience. It includes a choice from nine different standard receptacles to match both wiring system and plug-in equipment. This facilitates replacement of a receptacle with another style whenever a change in equipment dictates it. The floor box can be used with ½ in. or ¾ in. conduits. It has four drilled and tapped ½ in. conduit holes plus two ¾ in. tapped conduit holes. If specified floor boxes may be obtained with all conduit holes either ½ in. or ¾ in.

Thomas & Betts Co., 36 Butler St., Elizabeth, N. J.



Industrial Fixture (4)

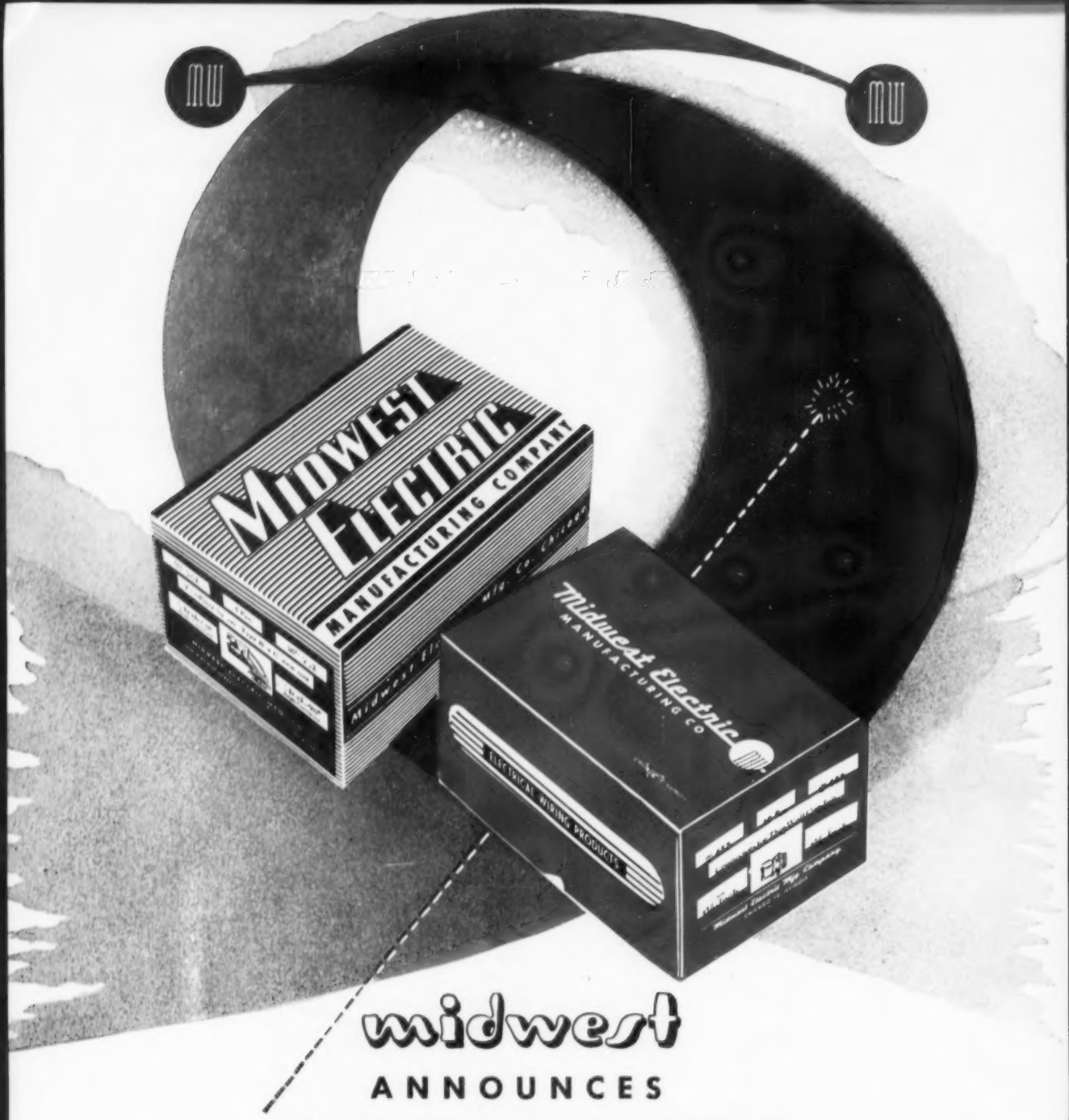
Industrial fixture line utilizes the higher light output of 8-ft Power-Groove lamps, with series that includes Nos. CFI-15, CFI-20, CFI-30 and CFI-30L. It features closed-end porcelain enamel reflectors with reinforced ribs and embossed apertures. Fixture No. CFI-20 is designed for high, medium or lo-bay installation. It is shielded with a Cleartex unbreakable plastic panel, that may be cleaned easily with a regular household detergent. For industrial applications where high output footcandle levels are to be maintained and reflected glare cut to a minimum. CFI-15, is used for all medium and high-bay installations. CFI-30, is to be used where fixtures are viewed crosswise and brightness is to be reduced. CFI 30L, is for conditions where only louvered equipment can qualify.

Day-Brite Lighting, Inc., 16 N. 9th St., St. Louis, Mo.

Transformers (5)

A specially designed transformer with maximum ratings of 600 volts and sizes through 15 kva, both single and 3 phase. Transformers are all-welded, steel encased, and filled with compound, making them as near explosion-proof as possible. They are designed for indoor or outdoor use.

The Standard Transformer Co., Warren, Ohio



midwest

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Midwest Electric Mfg. Company

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

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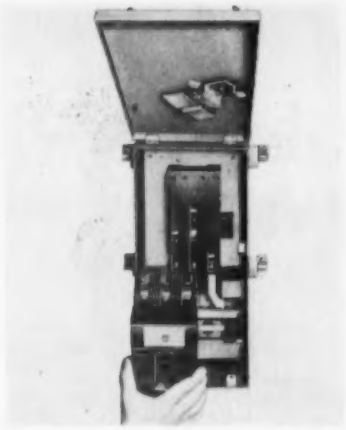
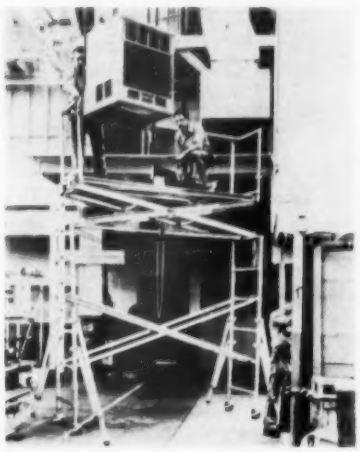


Plug-In Disconnect (6)

A single bus duct plug-in disconnector unit that can be used for all ratings from 15 amps, 250 volts to 100 amps, 600 volts is designed to simplify inventory and installation problems. Enclosures are supplied with an interlocking cover that prevents opening when breaker is in "on" position. A positive handle mechanism, that may be padlocked, plainly indicates "on", "off" or "tripped" breaker position. These units are interchangeable for use in the bus duct unit, as individually enclosed breakers or in lighting and power distribution panelboards. A neutral plug for use on 3-phase, 4-wire circuits is available as an accessory.

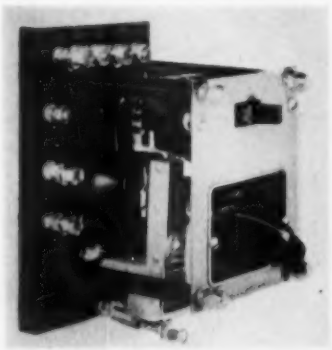
Federal Pacific Electric Company, 50 Paris St., Newark 5, N. J.



Scaffolds (7)

An adjustable high-level platform on wheels brings overhead fixtures within easy reach for maintenance in industrial plants. The aluminum structure rolls down narrow aisles, under beams and pipes, and through doorways. Assembled in less than two minutes. Unique jackknife design with chain operated screw drive permits raising and lowering platform to any height between 6 ft and 12 ft above floor.

Up-Right Scaffolds, 1013 Pardee St., Berkeley 10, Calif.



Remote Control Unit (8)

This gasoline engine remote control unit is designed primarily for adapting pushbutton started electric plants for use as stand-by plants. The ASCO Bulletin 216 controls, together with a transfer switch, adapt plants which utilize a 2-button system of control to automatic operation. Units contain the relays necessary to provide cranking disconnect upon engine firing and overcranking disconnect and lockout if the engine fails to fire. The units also have a 4-position selector switch (manual, stop, automatic, and test.)

Automatic Switch Company, Florham Park, N. J.

Mercury Lamps (9)

Recommended for heavy duty services both indoors and out, these new lamps are made with outer bulbs of a hard and tough glass which resists breakage resulting from exposure to rain, snow, and large flying insects. The "Weather-Duty" lamps are interchangeable with present mercury lamps and are suitable for outdoor use in open type fixtures or in enclosing fixtures which are not completely watertight. They are especially suited to ventilated fixtures for they withstand the corrosive effects of industrial fumes and water splashing through the reflector openings.

Westinghouse Electric Corporation, Bloomfield, N. J.

Conduit Bender (10)

This automatic conduit bender can produce 90 degree bends, offsets, and doglegs on any ½-in. to 1-in. rigid heavy wall conduit. Powered by a 115-volt, 25-60 cycle ac motor rated at ¼ hp, the "Condumatic" bender is constructed of heat treated aluminum and rolls on a set of rubber-tired wheels to facilitate transportation from job to job. The unit measures 33 in. high by 15 in. wide and is available with accessory shoes for bends of 3-, 3½-, and 4½-inch radii.

Chamor Manufacturing Corporation, 43-63-11th St., Long Island City, N. Y.

Lighting Fixtures (11)

A vaportight and dustproof fixture for use in lighting inside and outside entrances, corridors, stair landings, schools, hospitals, and public buildings. Unit is made of satin finished aluminum and measures 5½ in. wide by 8⅜ in. long. The fixture has an opalescent globe, and can be used with lamps of up to 200 watts, A25 maximum. It can be mounted on SE, SEH or SK series condulets, or 3½-in. or 4-in. outlet boxes.

Crouse Hinds Company, Wolf and Seventh North Sts., Syracuse 1, N. Y.

Unbelievable Time and Labor Savings!

Beaver's NEW "Speed-Cut" Abrasive Cut-off Machine No. 20

NOTE THESE TREMENDOUS TIME SAVINGS!

SIZE	MATERIAL	CUTTING TIME
2"	Steel Pipe	5 Seconds
4"	Cast Iron Soil Pipe	6 Seconds
6"	Steel Pipe	40 Seconds
2"	Cold Rolled Steel	20 Seconds
4 x 4 x 3/8"	Steel Angle	12 Seconds
4"	Steel Channel	10 Seconds
2"	Galvanized Pipe	5 Seconds

CAPACITY

No. 20 with 20" wheel . . . 6" pipe; 2½" solid stock
No. 14 with 14" wheel . . . 4" pipe; 2 " solid stock

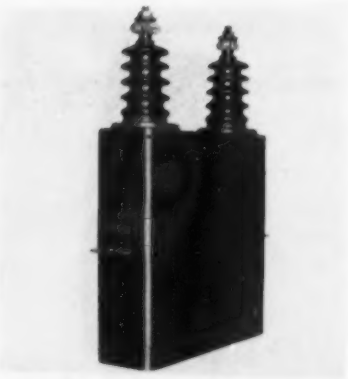
ONE MAN CAN CUT MATERIAL FOR A LARGE CREW OF MEN!

"Threaded Pipe—It's Tight—It's Best—Costs Less"

CAN'T TELL IT ALL HERE!
Write for latest facts on all Beaver Machines!

BEAVER PIPE TOOLS INC.
279-500 DANA AVE.
WARREN, OHIO

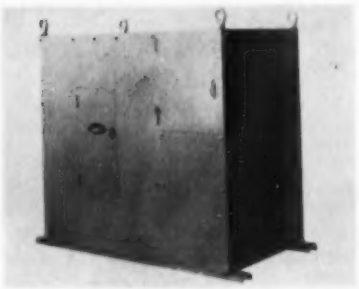
HAVE A CUTTING OR THREADING PROBLEM?
Let Our Engineering Research Department help you solve it.



Capacitor (12)

New 25-kilovar capacitor now features a fabricated, corrosion-resistant steel case. The case is formed and precision welded at top and bottom and down one side by an automated machine, with mounting brackets projection-welded to the case sides. The case material will withstand the most severe atmospheric conditions and repainting of units will not be required. Units are 4 in. wide and overall height is 20½ to 21¾ in high. It is available in ratings from 2,400 to 13,800 volts.

General Electric Co., Schenectady 5, N. Y.



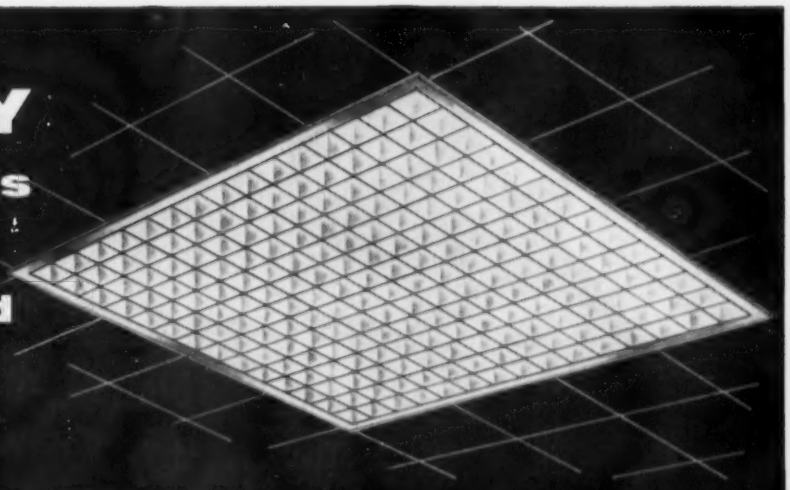
Dry-Type Transformer (13)

Incoming line, transformer and outgoing feeder are compactly arranged in a new standard dry-type transformer for inplant distribution of power. Unit is 63½ in. high, 74 in long and 38 in. deep. Operation and routine servicing can be done from front of unit. Distribution center is rated at 112.5 kva, 3-phase, 4160 to 208y/120. High voltage is equipped with 3 kva lightning arresters, and gang operated oil fused cutouts. Low voltage section has 3-pole, thermal magnetic molded case circuit breakers.

The Standard Transformer Company, Warren, Ohio.

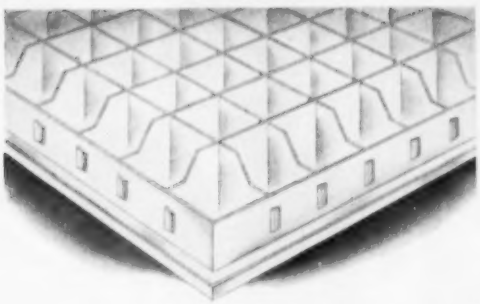
GARCY

5600 series 4′ x 4′ Recessed Lighting



Lightweight one-piece louver
reduces fixture weight . . . adds strength

No Wavy Lines

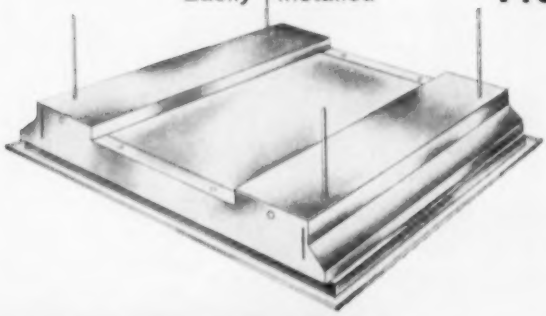


Unique One-Piece Framed Louver Cannot Sag or Lose Its Shape

Interlocking aluminum fins are rigidly locked into hinged frames. The total weight of this large area fixture is reduced by 25% imposing less burden on the ceiling.

Louvers cannot twist or bend out of alignment . . . no unsightly wavy lines. Small cell size provides soft, even lighting. Lamp placement in relation to louver fins assures even brightness, ample shielding.

Easily | Installed

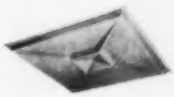


Die-Formed, Twin-Channel Housing Provides Greater Rigidity

Extra forming means greater rigidity without extra weight. The ballasts are located in channels. Heat from the ballasts is more efficiently dissipated because of the greater surface area provided.

Ease of installation is assured . . . hinged frames fit precisely . . . trim flanges fit snugly against the ceiling. Other sizes: 2′ x 2′, 2′ x 4′, 2′ x 8′.

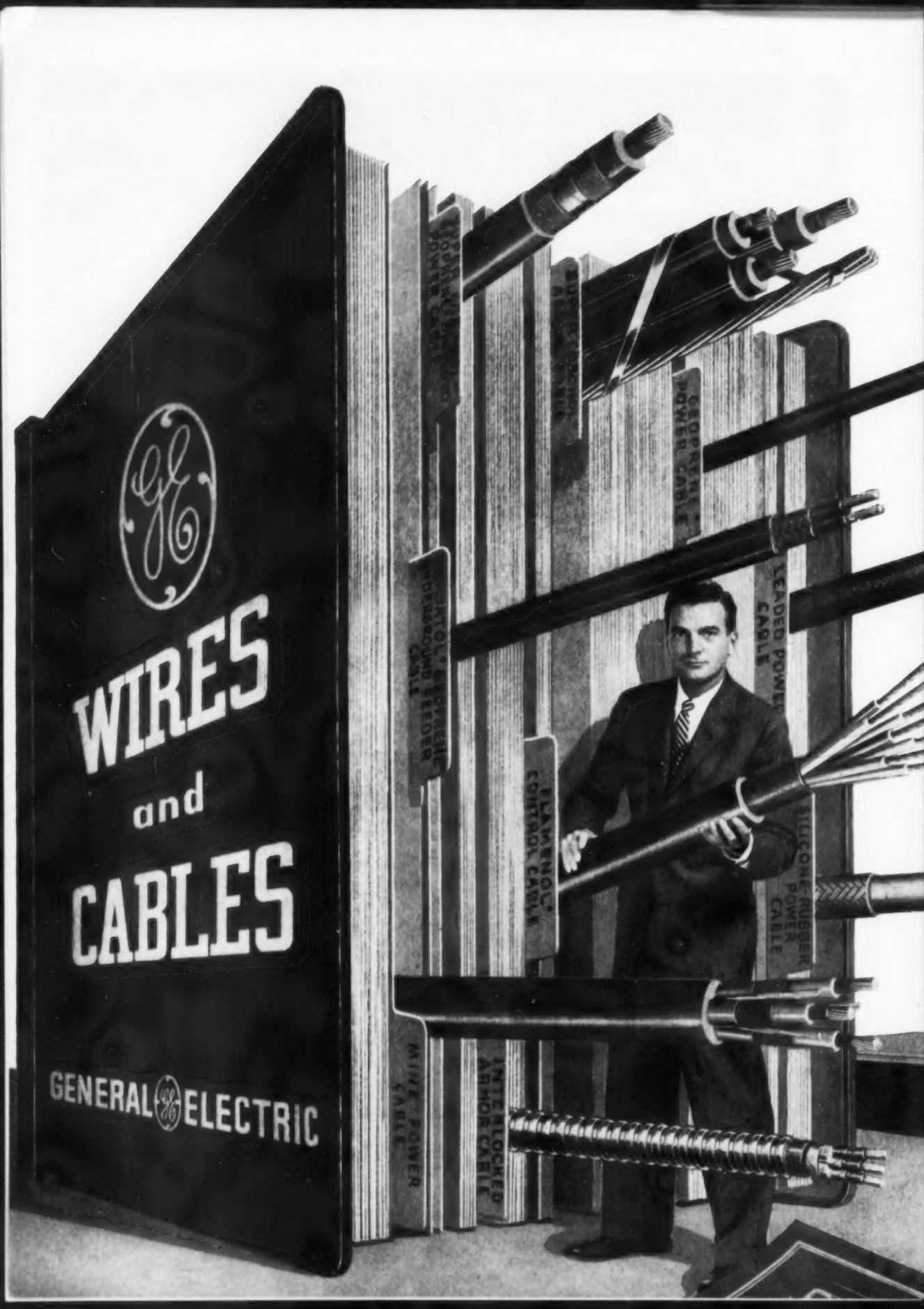
Send for Bulletin 552-L.



Also available with one-piece plastic shield.

GARCY
Preferred for Performance
COMPLETE COMMERCIAL LIGHTING

Garden City Plating and Manufacturing Company
1730 North Ashland Avenue • Chicago 22, Illinois
In Canada: Garcy of Canada, Ltd., 1244 Dufferin Street, Toronto 4


WIRES
and
CABLES
GENERAL ELECTRIC
NEOPRENE POWER CABLE
GEOPRENE POWER CABLE
LEADED POWER CABLE
"FLAMENOL" CONTROL CABLE
SILICONE RUBBER POWER CABLE
INTERLOCKED ARMOR CABLE
WIRE & POWER CABLE

catalogs full of cables... but

which one is right for your job?

This problem of selection is one of the important reasons why many electrical contractors work with General Electric wire and cable engineers when they're planning important wiring jobs.

Today, selection of the best wires and cables for your customers' particular needs calls for consideration of a wide variety of factors ranging from standard requirements such as flame-, heat-, moisture-, and weather-resistance — to special constructions which withstand vibration, the electromagnetic effects of adjacent power cables —even the effects of atomic radiation.

General Electric's knowledge of the requirements of other basic components of power distribution systems—transformers, load centers, switchgear, etc.—has led to the conviction that the right cable plays an important part in satisfactory system performance.

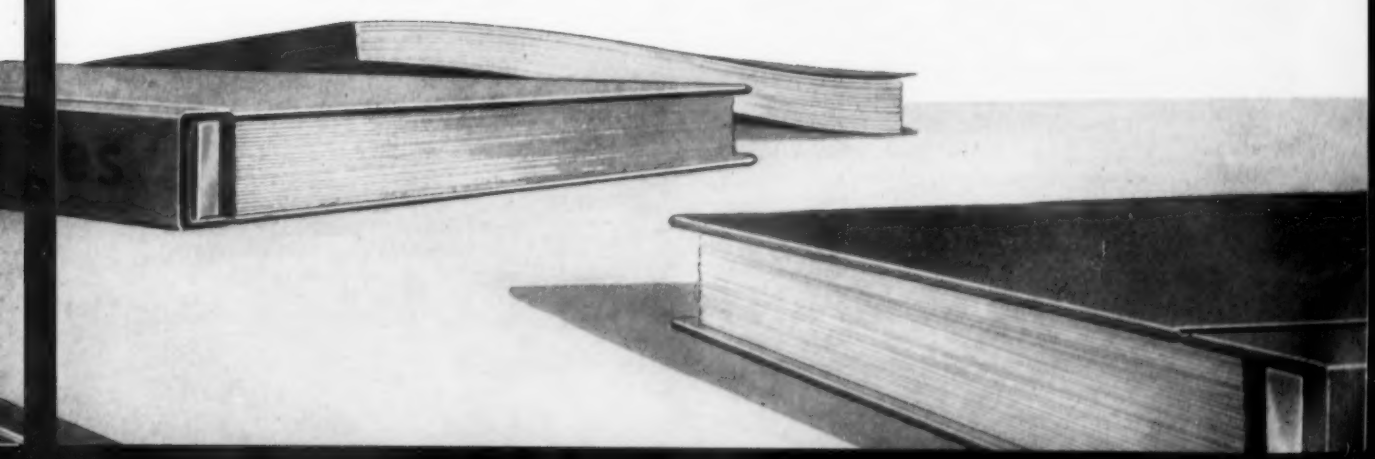
As a result, General Electric has developed hundreds of cables for just about every possible application. Thus, G-E engineers are not limited to one wire or cable for a given job but can suggest the most efficient and economical solution for the particular situation.

All this adds up to experience that can benefit you. Take advantage of it the next time you have a cable selection problem. For information on your specific wire and cable application or selection problem, see the G-E wire and cable specialist in your locality or write Section W201C-818, Wire and Cable Department, General Electric Company, Bridgeport 2, Connecticut.

®Registered Trade-mark General Electric Company

Progress Is Our Most Important Product

GENERAL ELECTRIC



NEW! PORTER® QUIK-STIK POLYETHYLENE ELECTRICAL TAPE

PORTER SINGLE-PAK
(¾ in. x 66 ft.)

Remains flexible in cold weather!

PORTER
JOB-PAK
(¾ in. x 20 ft.
—12 rolls)

Check the outstanding features of this one wrap primary insulation tape!

- Remains flexible from —70°F to +200°F.
- Total dielectric strength more than 10,000 volts.
- Maintains constant power factor over extremely wide frequency range.
- Resists corona conductivity; moisture; oils; greases; solvents; chemicals; fungi; bacteria; abrasion; creep; aging.
- Physically stable; non-corrosive; non-drying; non-polarizing; chemically inert.

Order from your wholesaler today!

For more information, write: *H. K. Porter Company, Inc., Quaker Rubber Works, Philadelphia 24, Pa. or Pioneer Works, Pittsburg, Calif.*

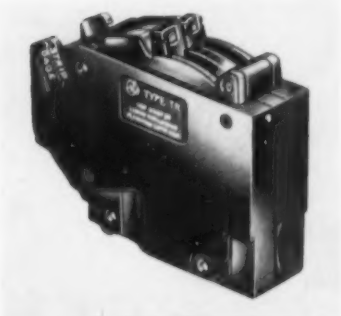
QUAKER RUBBER DIVISION

H. K. PORTER COMPANY, INC.

Floodlighting **(14)**

Floodlighting system for store windows, interiors, galleries, displays, and exhibits, is a combination of trolley duct and adjustable flood lighting. It provides universal adjustability without wing nuts or set screws. Units are available in four popular shade designs, and in single or double non-shade devices. Completely wired and ready to use, it is provided with patented spring-tension socket which adjusts to any position and will stay put at any angle.

Swivelier Company, Inc., 42-34th St., Brooklyn 32, N. Y.

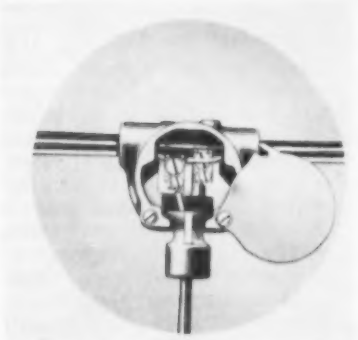


Circuit Breaker **(15)**

Compact plug-in breaker combines two breakers in a single 1-in. case, thereby enabling twice the number of circuits normally possible in an average load center. It is available in 15 and 20 amps with tie handle extensions for 2-pole operation. Each pole of the type TR breaker consists of thermal-magnetic tripping mechanisms. Spring-reinforced bus receptacles hold it firmly in place when plugged into load center. Panels for breakers are available, with load centers in main ratings from 40 to 200-amps, and from 2 to 40 circuits. Spring mounted interiors provide auto-

matic front alignment that speeds installation and eliminates time-consuming adjustments. Listed by UL, unit has an interrupting rating of 5000 amps ac.

General Electric Co., Plainville, Conn.



Conduit (16)

Fastened by conduit and conduit straps, this new lighting fixture hanger condulet need not be attached to or supported from the ceiling. Since the fixture and ball nipple are wired first, the fixture is hung by placing the ball of the hanger in the bottom recess of the condulet. The condulet's cover swings aside to expose the wiring and ample space is provided for splicing the fixture wires to the circuit conductors.

Crouse Hinds Company, Wolf and Seventh North Sts., Syracuse 1, N. Y.

Heater and Lighter (17)

Overhead heater-light unit with exclusive plug-in assembly is now available. It features a factory-wired connection. It incorporates a fluorescent lamp and a 1500-watt heating element, with a six-inch fan in either model to direct heat down from the ceiling and circulate it evenly throughout the room.

Mission Appliance Corp., 12611 Crenshaw Blvd., Hawthorne, Calif.

Reducer Connector (18)

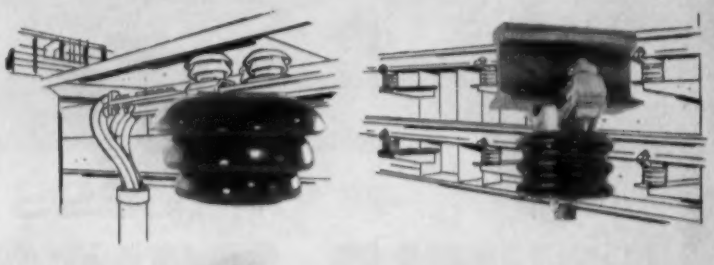
Long length sections and fittings, such as elbows, tees, crosses, and risers are joined together with this combination reducer and connector which may be used either right or left hand. Same item is used on various widths, according to degree of reduction: 3-, 6-, 9-, 12-, or 18-in. Extremely flexible, it saves material and installation time.

P-W Industries, Inc., Duncan and Melrose Sts., Philadelphia, Pa.

STRENGTH

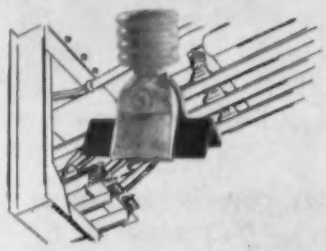
Which kind of strength do you need in insulators for traveling-contact equipment?

MAXIMUM ELECTRICAL STRENGTH



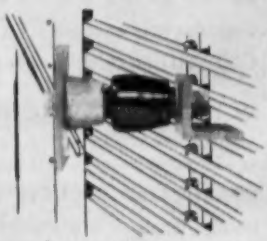
Wet-process porcelain insulators, such as these, offer outstanding electrical properties for high-voltage contact-rail insulation. Especially recommended where dirt, moisture, and other contaminants prevail.
Also available are dry-process porcelain units for power circuits.

MAXIMUM IMPACT STRENGTH



Molded polyester-fiberglass insulators and fabric-reinforced insulators of this general type have exceptional impact strength and vibration-resistance combined with good electrical properties. Tailored to resist chemicals, thermal shock, weathering.

MAXIMUM TENSILE STRENGTH



Molded Giant Strain insulators, adaptable to miniaturization where space is restricted, offer unusual mechanical strength. A very economical insulator having diverse applications.

TO HELP YOU DECIDE

. . . on the right combination of properties to meet your insulator needs, Delta-Star engineers from coast to coast invite your problems. Phone the nearest Delta-Star district office or write to Electric Service Works, Delta-Star Electric Division, H. K. Porter Company, Inc., 17th & Cambria Sts., Philadelphia 32, Pa.

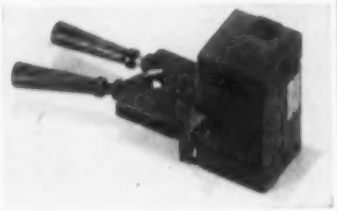
ELECTRIC SERVICE WORKS
DELTA-STAR ELECTRIC DIVISION
H. K. PORTER COMPANY, INC.

FRAMELESS

CADWELD® MOLDS

Eliminates All Frames

NEW E-Z CHANGE Handle Clamp fits directly into graphite mold — simplifies your equipment for making CADWELD Electrical Connections.



IN LESS THAN 3 SECONDS — change from one mold type to another.

DRASTICALLY REDUCES INVENTORY COSTS — E-Z CHANGE Handle Clamps are manufactured in just two sizes (one for 3" molds — one for 4" molds). One of each size will handle 95% of all types of STANDARD CADWELD Connections.

New molds are furnished complete with attached cover.

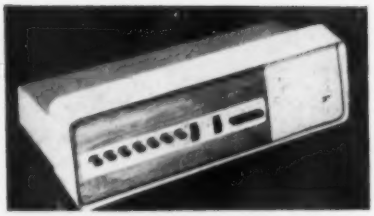
NO LOSS IN INVENTORY — NEW molds will fit STANDARD or QUICK-CHANGE frames you now have in stock.

CADWELD®

Erico Products, Inc.

2070 E. 61st Place Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario



Intercom System (19)

Special feedback circuits, giving low distortion and high speaker damping, resulting in a smooth, clear, natural sound, are features of this intercommunication system. The complete system is available in either 6- or 12-station masters with remotes, and with intermixing of master and remotes for innumerable possible arrangements. Masters may be set for conference calls, dictate, or talk-listen for complete flexibility. Other features are instrument quality pushbutton, printed circuits, optional handset for privacy, and feedback noise cancellation circuit for lower background noise.

Fisher Berkeley Corp., 5633 Grove St., Oakland, Calif.

Cable (20)

New type RHH-90°C—RHW 75° heat and moisture resistant rubber and fibrous covered wire is now available. Designed for general use in wet or dry location, it is listed by U.L. for 600-volt service in sizes 14 through 6 AWG. The insulation is Nepcozone Butyl, developed for high voltage cable where its ozone and corona resistant properties are desired. This wire can be used in industrial plants and boiler rooms where heat and moisture may be present and where rubber insulation characteristics may be preferred.

National Electric Products Corporation, Gateway Center, Pittsburgh, Pa.

Chime and Clock (21)

Designed for the kitchen, den, or family room, "Chime-Time" is a combination door chime and clock available in copper finish with either white or black. The chime mechanism sounds two notes for the front door and one for auxiliary entrance. The self-starting electric clock is powered by Telechron. Both clock and chime operate directly from any 16-volt transformer and the unit is designed for recess or surface wall mounting.

The Rittenhouse Company, Inc., Honeoye Falls, N. Y.

Agree?

There's a lot of Planned Quality Lighting Here at Standard Fixture Cost!

Appearance as well as cost were important considerations in this new bank installation by Litecontrol. But the primary objective was good *functional* lighting!

Litecontrol recessed curved-lens troffers were used throughout to do two jobs: (1) Staggered over the public area they provide moderate light intensity (2) Over the tellers' counters under the balcony, they step up the intensity to the precise high level that's needed. Even the mural on the wall is adequately lighted by the row of lens troffers — no supplementary lighting is used or required. The mural is clearly visible even from the street.

If *you* have photos to show of an installation like this, you know that you not only have a satisfied customer but you make a lot of new friends. Consider LITECONTROL on your next public lighting job.

INSTALLATION:
Watertown Federal Savings & Loan Association
Watertown, Massachusetts.

AREA:
Main banking area.

ARCHITECT:
Daniel C. C. Gilbert, New York City, New York.

ASSOCIATE ARCHITECT:
Davis Hamerstrom, New York City, New York.

DESIGNERS:
Benedict-Hamerstrom, New York City, New York.

CONSULTING ENGINEERS:
Albert Fentzloff, Inc., Gustave B. Weiser,
New York City, New York.

ELECTRICAL CONTRACTOR:
Howes Electric Company, Watertown, Mass.

FIXTURES:
Litecontrol No. 4734RS in Public Area;
No. 4724RS in rows over Tellers' Counter.

INTENSITY:
Average in Public Area, 25 footcandles in service.
Average on Tellers' Counter, 85 footcandles in service.

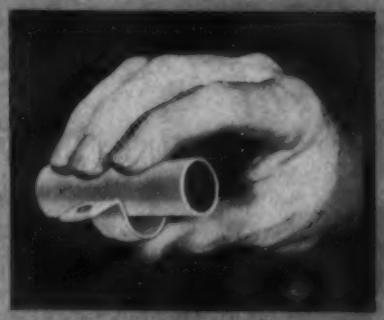
LITECONTROL *Fixtures*

KEEP UPKEEP DOWN

LITECONTROL CORPORATION, 36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

Snap..!



It's on to stay

Blackhawk Snap Strap

with exclusive "hold bump"

The Blackhawk snap strap snaps tighter . . . really holds its grip. That's because of the "hold bump" at the open end of the bracket. Ribbed bracket adds to the snap, provides rigid contact support of the conduit. Resists slips.

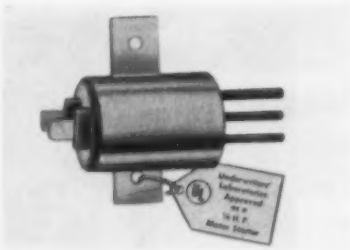
The Blackhawk snap strap means faster installations because it eliminates fumbling, dropping. Just snap the strap in place and you've got it. Saves plenty of on-the-job installing time. Specify and install the Blackhawk snap strap. Made of heavy gauge steel, zinc plated after fabrication. Wide range of sizes for rigid and thin-wall conduit.

Specify B-I when you buy!

Blackhawk Industries

BLACKHAWK INDUSTRIES

DUBUQUE, IOWA



Motor Starter **(23)**

The Guardian "Reloid", an electromagnetic switch actuated by a plunger, is now available in a version carrying UL approval as a ¼ hp industrial motor starter. Totally enclosed in a metal case, the relays are available for any voltage from 6 to 230 volts, 60 cycles ac or from 6 to 110 volts, dc. The three contact leads, plugged with molded bakelite, are equipped with either A.M.P. or Douglas type terminals, contacts being rated at up to 8 amps, non-inductive. Standard contact combination is single pole, either normally open or normally closed, double break or make. The unit measures 2½ in. by 1$\frac{5}{32}$ in. by 1$\frac{5}{32}$ in.

Guardian Elec. Mfg. Co., 1621 *West Walnut St., Chicago* 12, *Ill.*

Outdoor Lights **(24)**

All-weather cluster lights for home, garden, and commercial areas are designed for low budget lighting. Fixture is cast aluminum throughout, and finished in chromium, aluminum, or colors of green gold, red or black. For residence lighting of patios, gardens, flower beds, walks and steps, the unit comes with stake mounting or stake mounting design. For commercial lighting of parking lots, shopping areas, storage yards, motels and other outdoor applications. A wide variety of cast aluminum wiring troughs, boxes and pole fittings are available.

Stonco Electric Products Co., Kenilworth, N. J.

BEST

NEW SET SCREW FITTING FOR EMT

A COMPLETELY NEW EFCOR PRODUCT!

- STAKED-IN screw never falls out.
- FREE-RIDING screw never freezes.
- DEEP-SLOTTED screw keeps screwdriver from slipping.
- TIGHTER-GRIPPING twin-bite cup-shaped screwpoint.
- UL approved – concrete tight.

ADVANCED ENGINEERING FEATURES!

- MADE OF TUBING – one-piece, heavy-wall construction.
- HEX SHOULDER provides holding surface for wrench or plier installation.
- See your Electrical Wholesaler – **write for free sample and folder.**

FOR THE NEWEST TOP QUALITY LINE OF SET SCREW FITTINGS

EFCOR

ELECTRICAL FITTINGS CORPORATION • 37-50 57th STREET, WOODSIDE 77, NEW YORK

80 Pounds of Heavy-Duty Power For Easier Threading On The Job!

ONE MAN CAN CARRY IT
WRENCHLESS CHUCK GRIPS TIGHT FOR BOTH RIGHT AND LEFT HAND OPERATION
CLOSE
OPEN
RUGGED ALUMINUM CASE
YOUR CHOICE OF ELECTRIC, GASOLINE OR AIR MOTOR
OSTER
FEATHERWEIGHT CHAMP
THE OSTER MFG. CO.
USE IT TO THREAD, REAM, CUT OFF, OR TURN UP FITTINGS
STURDY, STEEL STAND FOLDS FOR EASY CARRYING
NOTE THE HANDY TOOL RACK ON THIS CHIP PAN
STANDARD RANGE: 1/8" TO 2" PIPE
EXTRA RANGE: UP TO 12" PIPE

OSTER NO. 142 Featherweight CHAMP

Power Drive For Hand Pipe Tools

Now, thread 1" pipe up to six times faster than by hand . . . in the shop, in the truck or on the job . . . with your present hand tools and this powerful Oster No. 142 Featherweight Champ.

See this and other dependable Oster pipe machines at your nearby Oster Selective Distributor. Ask about the special time-payment purchase plan whereby you can buy any Oster machine for only 25% down.

For descriptive literature, write to:

OSTER
Builders of the World's Most Complete Line of Threading Equipment
For other Models write for General Catalog

THE OSTER MANUFACTURING CO., 1313 East 289th St., Wickliffe (Cleveland), Ohio

Lighting Equipment **(25)**

Completely redesigned, the new Miller-Ivanhoe line of incandescent and mercury lighting equipment features two mounting and socket assemblies to facilitate installation and maintenance. The lamps are provided with louvered ventilated reflector necks to protect the lamp from moisture. Steel reflectors are white porcelain enameled both inside and out.

The Miller Company, Meriden, Conn.

Switchboard **(26)**

Low-voltage switchboard, built in standardized modules, is designed for any incoming service, 600 volts or less. Its mains are rated 800 through 4,000 amps. It will accommodate any combination of seven different low-voltage protective devices which are divided into three classes. It allows protective devices to be added, replaced, or rearranged in the field at minimum labor. The mains are bus bars mounted horizontally in the center of each section, leaving the top and bottom area free from incoming busway or cable. The vertical bus bars are rated at 600 amps each. All connection straps, cable lugs and bus bars are silver-plated.

General Electric, Distribution Assemblies Dept., Plainville, Conn.

How to determine proper Control Run for Remote Control Switches

With remote control switches (as with any electromagnetically operated device), it is absolutely essential that maximum allowable run for each switch should not be exceeded.

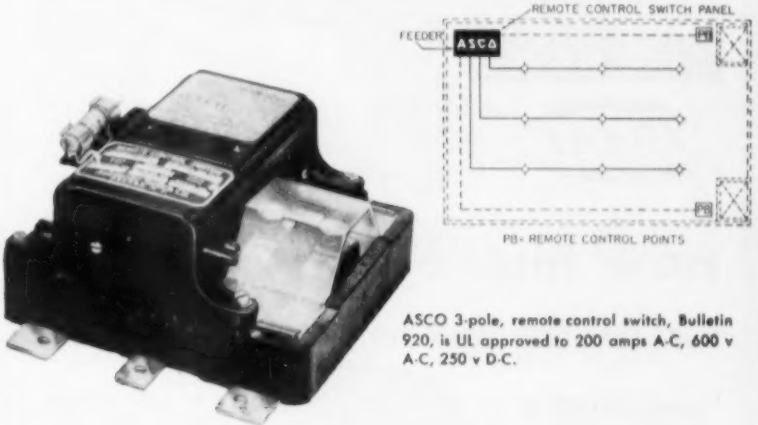
Here is a handy guide to help you determine admissible distances between switch and remotely located control station:

1. Doubling the control voltage will increase the allowable run with the same size of wire by about 4 times.
2. Doubling the cross sectional area of the control conductors will increase the allowable control run by 2 times. The cross sectional area of a conductor will approximately double with three gauge number sizes larger wire. Thus #14 has approximately double the area of #17, and one-half the resistance per unit length.
3. Full consideration should be given to the use of auxiliary relay control for remote control switches, particularly for group installations requiring master control and for extremely long runs.

The following tabular data specify maximum distance between control station and one Bulletin 920 switch with source line voltage at 90% of normal. Similar charts are available on the range of ASCO "remotes."

AMPERES	B&S GAUGE	DISTANCE IN FEET 110 V. 60 CYS.	220 V. 60 CYS.*
30,60,75	14	550	1600
	12	900	2600
	10	1400	4200
100,150,200	14	325	1200
	12	500	1900
	10	800	3000

*For 208 volt system, reduce 220 volt values by 30%.



ASCO 3-pole, remote control switch, Bulletin 920, is UL approved to 200 amps A-C, 600 v A-C, 250 v D-C.

Why Mechanically Held

A remote control switch is essentially a feeder disconnect switch. Consequently, it is usually installed in a lighting or power distribution panel feeding numerous circuits. In function the disconnect switch used should operate just like the manually operated type of disconnect switch—it should be unaffected by line voltage conditions and should respond only to the control of the push buttons.

Only a mechanically held switch can meet these requirements. Magnetically held contactors, which open on momentary line voltage dips and control circuit derangements, introduce the hazard of complete outage on vital circuits until repairs can be made.

ASCO Mechanically Held Remote Control Switches are unaffected by line voltage conditions; each switch includes a manual operating knob or handle so that the switches can be operated manually at any time.

The values for control run listed are for one switch. For installations involving more than one remote control switch connected to the same control conductors, the values listed can be considered as switch-feet. The allowable run for group installations will be equal to the listed values divided by the number of remote control switches operating from the same control conductors. Thus, if one switch has an allowable run of 100 feet with #14 wire, ten switches will be limited to 10 feet. When switches are located along a transmission control line, calculations in terms of switch-feet will produce the solution.

Dependable control by ASCO

New catalog 57-S2 on ASCO Remote Control Switches is now available. Write today for this basic reference on dependable electromagnetic control.

ASCO®

Automatic Switch Co.

50-J Hanover Road, Florham Park, New Jersey

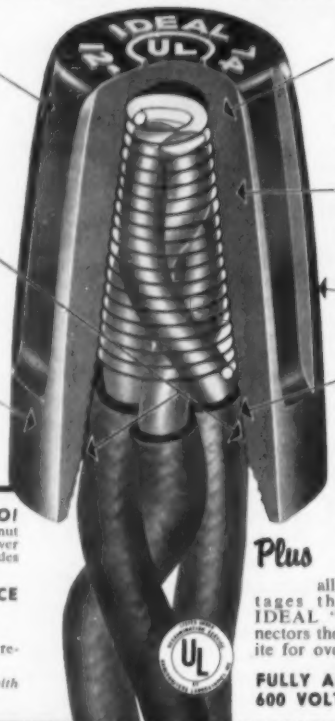
FRontier 7-4600

Have You Noticed the Difference?

the NEW IDEAL Wire-Nut® CONNECTORS

now improved 7 ways!

MORE THAN EVER—YOUR BEST BET IN WIRE CONNECTORS



NEW KNURLING
Easier to tighten and handle—more shell thickness around wires than any other connector.

NEW WIDER THROAT
Makes it easier to join *larger* wire combinations—no fumbling when inserting wires into *this* connector.

NEW LONGER SKIRT
No chance for flash-over or exposure of bare wire.

NEW CLOSER TOLERANCES
In both spring insert and shell give you a still stronger, "firmer" joint.

NEW PHENOLIC COMPOUNDS
Make shell stronger than ever and more uniform.

NEW CURING
Better weathering, aging and porosity characteristics.

NEW BUTTRESS THREADS
Increase strength of shell, make it easier to "slide" wires into insert and help eliminate chance of flash-over.

THEY NEVER LET GO!
Just screw them on like a nut on a bolt. Screw-and-Lever and Wedge Action provides up to

2½* TONS OF FORCE . . . A WIRE CRUSHING GRIP
that actually flattens and reforms wire.

* *"Wire-Nut" Size 74B with 2 No. 14 Wires.*

Plus
all the other advantages that have made IDEAL "Wire-Nut" Connectors the industry's favorite for over 30 years.

FULLY APPROVED 600 VOLTS

SOLD THROUGH AMERICA'S LEADING DISTRIBUTORS

IDEAL

IDEAL INDUSTRIES, INC.
1041-H Park Avenue, Sycamore, Illinois
Please send catalog on Ideal "Wire-Nuts" Connectors.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

Canadian Distributor: IRVING SMITH, LTD., Montreal

Glow Switch (27)

Addition of a "Glow" switch in the low-voltage line pinpoints the location of the switch even in a completely darkened room. The silent "butterfly" switch made of phosphorescent material is available in combinations of one to four switches on a standard size wall plate, as well as on an 8-position master control. There may be as many as four switches on a plate. Plates are available in buff or clear design with gold-tone inserts. For those who prefer "color-matched" switch plates, the gold-tone card insert can be painted to match the wall or used as a pattern for making wallpaper inserts.

Remcon Division, Pyramid Instrument Corp., 630 Merrick Road, Lynbrook, N. Y.

Audio Cables (28)

New audio cables include two types of speaker extension lines to be used where shields are not required. These are manufactured in impedances from 16 to 500 ohms and distances from 200 to 2000 ft. Both types have 18 gauge, stranded, tinned copper conductors, vinyl insulation, and two conductors cabled. For high power, low loss, shielded, extension speaker lines, two types of cable have been developed, both having 16 gauge, stranded, tinned, copper conductors, vinyl insulation, and two conductors cabled. One type has a tinned copper braided shield with no outer jacket; the other has a tinned copper spiral shield jacketed with tubbed chrome vinyl.

Belden Manufacturing Company, Chicago 80, Ill.

Instrument (29)

Resistance measuring instrument, model 47A Milliohmmeter is designed for the measurement of low and very low resistances, covering a range from 20 micro-ohms to 1200 ohms over seven decades. This is a portable, direct-reading instru-

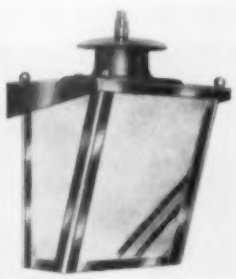
ment, line operated with no batteries being required. It employs ac test currents at line voltage frequency. Instrument uses the four terminal principle. It incorporates a self-calibration circuit which allows the accuracy of the instrument to be checked at any time.

Herman H. Sticht Co., Inc., 27 Park Place, New York 7, N. Y.

Switchgear **(30)**

Outdoor metal-clad switchgear provides features of indoor type in a weatherproof enclosure. The shelter has aisle for all-weather operation and maintenance. The aisle space is large enough to permit two breakers to pass side by side. This design is suited to a double-row-double bus arrangement. Smaller concrete slab is required because this unit needs no operating or breaker-drawout pad. Screened ventilating openings are provided in the enclosure.

Westinghouse Electric Corp., P.O. Box 2099, Pittsburgh 30, Pa.



Post Light **(31)**

Modern post lantern for entrance, patio, driveway, or porch. The line offers a wide selection of wall, ceiling and post lanterns. Finishes include: black, black with brass trim, antique copper, polished brass, aluminum, white with brass trim. Catalog available.

Markstone Mfg. Co., 1531 Kingsbury St., Chicago 20, Ill.

Takes the "UGH" out of TOUGH wire pulling jobs

IDEAL WIRE LUBE

- *Makes Wire Pulling Easier, Gets the Job Done Faster*
- *Protects Insulation Against Breaks and Strains*
- *Use it on Rubber, Lead or Plastic Covered Wire or Cable*
- *Available in pint, quart, 1-gallon, 5-gallon and 55-gallon Containers, Also in Handy Tubes*

"Wire Lube" is a special formula lubricant that makes the toughest, muscle-straining wire pulling jobs quick, simple, easy. The liquid lubricant can be hand or brush applied to wire or cable as it is pulled into the conduit. Wires and cable "rides" in on a film of lubricant which quickly dries to a fine white powder. No sticky sludge forms to bond wire and conduit; in fact, the powder makes the removal of wires much easier. Wire Lube is non-corrosive, non-combustible and can't injure hands or clothing. Order today for easier wire pulling jobs tomorrow.

Also Available in New Tube Packages

Handy, individually packed tubes of Wire Lube are ideal additions to the electricians tool box. Each tube contains just enough Wire Lube for the average small job. Look for the attractive display carton on your Distributor's sales counter.

Mail Coupon For Catalog Details

IDEAL INDUSTRIES, INC.
1041-H Park Avenue, Sycamore, Illinois

Please send catalog on Ideal "Wire Lube"

Name_____

Company_____

Address_____

City_____ Zone___ State_____

Canadian Distributor: IRVING SMITH, LTD., Montreal

SOLD THROUGH IDEAL LEADING DISTRIBUTORS

New 535 RIDGID

Pipe and Bolt Threading Machine

with 1 Universal Die Head and 2 Sets of Pipe Dies ½" to 2"

The Complete Package **$460.00**

(slightly higher in Canada)

Your best buy for fast easy conduit work—by power

Full range of pipe and bolt dies for universal head available

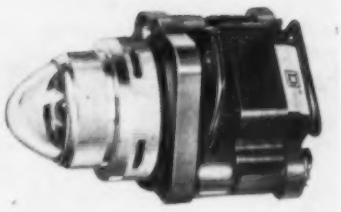
Complete machine, including Speed Chuck guaranteed to grip tight any conduit or pipe, forward, reverse . . . 1 universal quick-opening die head that adjusts to size right in machine, with 2 sets of dies, one for ½" and ¾", one for 1", 1¼", 1½" and 2". Roll type cut-off with self-centering full-floating cutter wheel . . . five-flute cone reamer, ⅛" to 2" . . . *Above 3 tools operate independently, swing up out of way when not in use, so conduit can be chucked from front* . . . Powerful 115/120 volt universal motor . . . All 500 and 500A die heads and accessories fit this 535 machine . . . See all the other RIDGID efficiency features of this remarkable 535 at your Supply House!

You can't afford to thread, cut and ream conduit by hand!

The Ridge Tool Company, Elyria, Ohio, U.S.A.

RIDGID

Work-Saver Pipe Tools



Pilot Light (32)

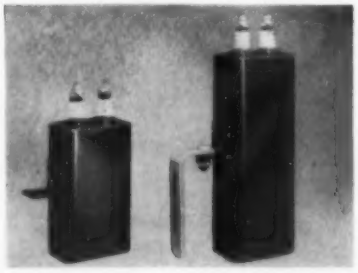
Oil-tight pilot light with glass cap is available in clear glass or one of five bright colors. The unit offers extra resistance to chemicals and abrasion in addition to its increased visibility. For unprotected areas where breakage is a possibility, interchangeable caps of plastic can be had in the same variety of colors. The new light is part of a complete line of oil-tight pilot devices.

Square D Company, 4041 N. Richards St., Milwaukee 12, Wis.

Dimmer (33)

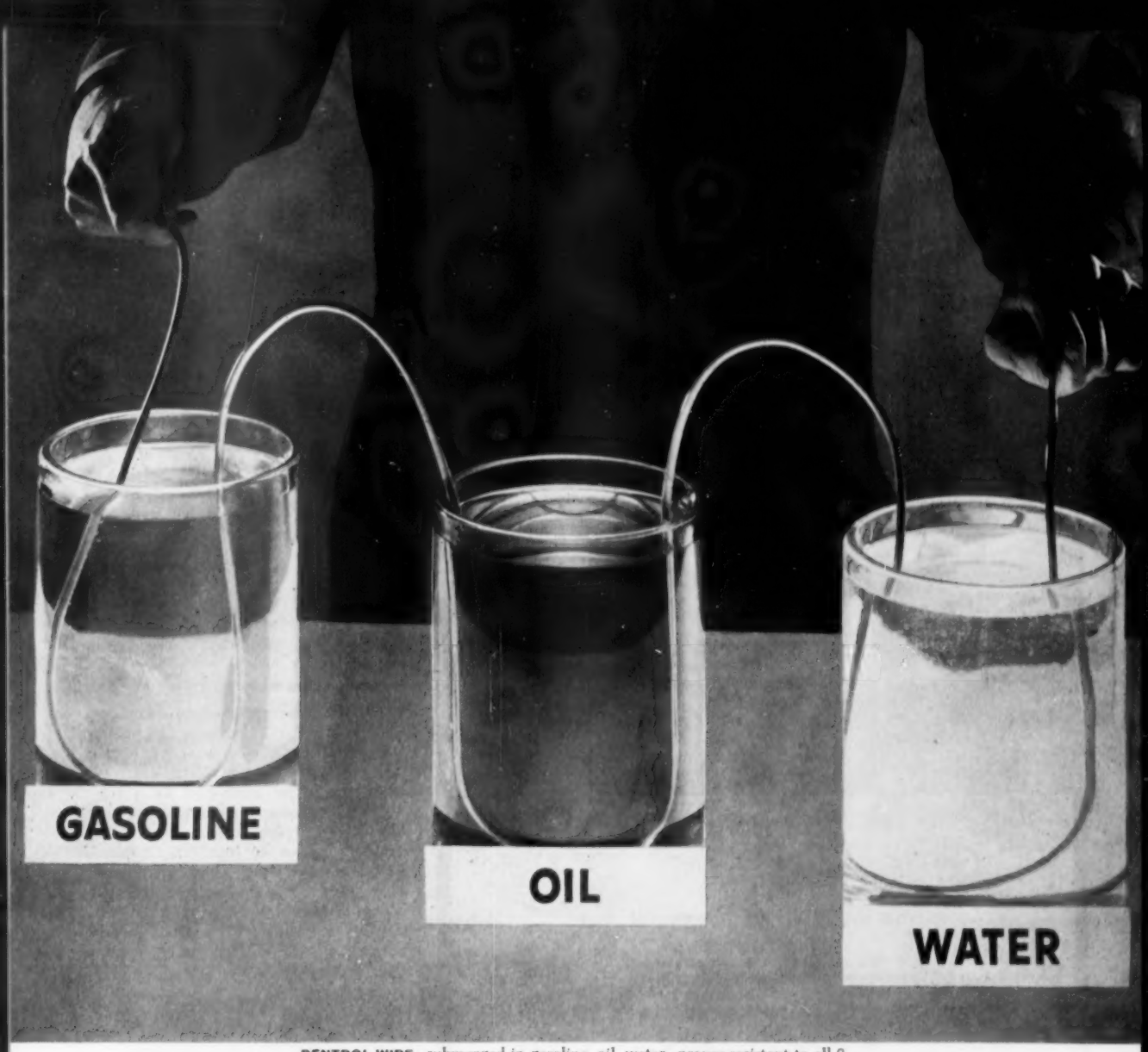
Miniature controls, fast response, load independence, exceptional linearity, and maintenance-free design are features of magnetic amplifier lighting dimmers. Standard sizes are available for maximum loads ranging from 3.2 to 25 kw. Intended for application in theatres, auditoriums or TV studios, the new dimmers use separate miniature controls. Reactor and transformer construction adhered strictly to AIEE standards. Dimmer units are air-cooled, rated for continuous operation with maximum temperature rise of 55C.

Ward Leonard Electric Co., Mount Vernon, N. Y.



Capacitors (34)

Rectangular design of these residential secondary capacitors permits complete impregnation of each unit, thus eliminating the possibility of internal failures caused by voids in the liquid dielectric. The units may be mounted in any position and feature alumina ceramic bushings. Lightweight and com-



DENTROL WIRE—submerged in gasoline, oil, water—proves resistant to all 3.

Dentrol, only type of thermoplastic wire that RESISTS ALL 3—GASOLINE, OIL, WATER!

Dentrol wire affords *new safety* wherever wiring is exposed to gasoline or oil—*new economy* over the lead-covered cable you're now using in these areas.

Made with a clear nylon jacket over-all, Dentrol not only beats gasoline, oil and moisture—but is exceptionally resistant to abrasion. It is easily installed (hard, smooth finish makes pulling through conduit simple), easily stripped, lightweight for easy handling.

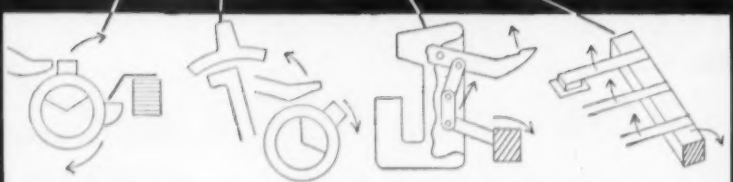
Suggested uses: for 600 volt wiring for lighting, power and control in and around service stations, refineries, tank farms, and industrial plants.

Dentrol is Underwriters' Laboratories approved as TW and "gasoline-resistant" wire for use in open raceways where exposed to gasoline or gasoline vapors. Thus it meets the provisions of section 5023 of the 1956 National Electrical Code, concerned with installations in hazardous locations.

Available in colors, and in 500′ cartons. See your Anaconda distributor. For information write: Anaconda Wire & Cable Company, 25 Broadway, N. Y. 4, N. Y. 57B4

SEE THE MAN FROM **ANACONDA®**
FOR **DENTROL WIRE**

only
circuit breakers prevent
fault single-phasing



1. Short circuit or overload involving any conductor trips lever, rotates common trip bar.

2. Rotating trip bar releases the latch arm —which rapidly moves upward.

3. Latch release activates quick-trip linkage, pivoting common breaker bar.

4. All breaker arms yoked to common bar... fault in one line trips all 3 poles.

THE ABOVE ACTION COMPLETELY CLEARS THE CIRCUIT IN AS LITTLE AS ⅛ CYCLE.

Westinghouse AB breakers
trip ALL THREE poles
on any circuit fault

YOU CAN BE SURE... IF IT'S
Westinghouse

WESTINGHOUSE ELECTRIC CORP., BOX 868, PITTSBURGH 30, PA.

J-30260-A

pact, they utilize a standard EEI-NEMA lightning arrester-cut-out mounting bracket and are suitable for either cross-arm or direct-to-pole mounting. Capacitors will be available in 3, 5, and 7½ kvar, 240-volt ratings and will have a red-flag indicating fuse and thermostatic switch as optional equipment.

General Electric Company, Schenectady 5, N. Y.

Mobile Dimmer **(35)**

Mobile dimmer control panel is designed for theaters, schools, churches, hotels, or any other application where controlled light is required. The unit has 22 1000-watt circuits, each circuit having its own dimmer and a switch to convert it to a master dimmer. Master and individual dimmers may be operated separately or simultaneously.

Gemco Electric Co., 25685 West Eight Mile Road, Detroit 19, Mich.

Recess Fixture **(36)**

Ratchet type flange for recessed ceiling fixtures makes lamp changing easy. Flange fastening unit, called "Ro Tite" holds ceiling flange to recessed fixture through an internal ratchet mechanism. To change lamp, simply turn flange, and to replace, turn in opposite direction.

Curtis Lighting, Inc., 6135 W. 65th St., Chicago 38, Ill.

FROM THESE SIMPLE, BASIC PARTS

ANY COMBINATION FITTING YOU NEED

New IDEAL SIMPLET UNIVERSAL FITTING

open-face bodies and hub-covers—easily assembled in seconds

- RUGGED, DURABLE MALLEABLE IRON
- MEET J.I.C. AND N.M.T.B.A. STANDARDS
- HUBS REVISED WITHOUT REPLACING FITTING
- LARGER WIRING AREA
- COVERS SUPPLY HUBS FOR CONDUIT — NO NEED TO DRILL
- PRECISION TAPERED PIPE THREADS
- MOUNTING LUGS, CONDUIT STOPS
- LIQUID, DUST, LINT PROOF

Ideal-Simplet introduces this revolutionary advance in conduit fitting design with the *new* Universal Fitting. It provides an almost infinite variety of hub combinations for practically any wiring job!

With only *five* basic body sizes and a wide choice of covers, every practical style and type of fitting with multiple hubs can be assembled in a matter of seconds. Your fittings inventory and overall costs can be substantially reduced. Standards, "specials" and even seldom-used styles are available immediately from stock!

It would pay you to get the facts about this new Ideal-Simplet Universal Fitting, NOW!

SEE YOUR WHOLESALER . . . or send coupon →

Pioneers in conduit fittings and electrical specialties

IDEAL

SIMPLET FITTINGS, Inc.
A Subsidiary of Ideal Industries, Inc.
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IDEAL-SIMPLET FITTINGS, Inc.
1041-H Park Avenue, Sycamore, Ill. IDEAL

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Name_____

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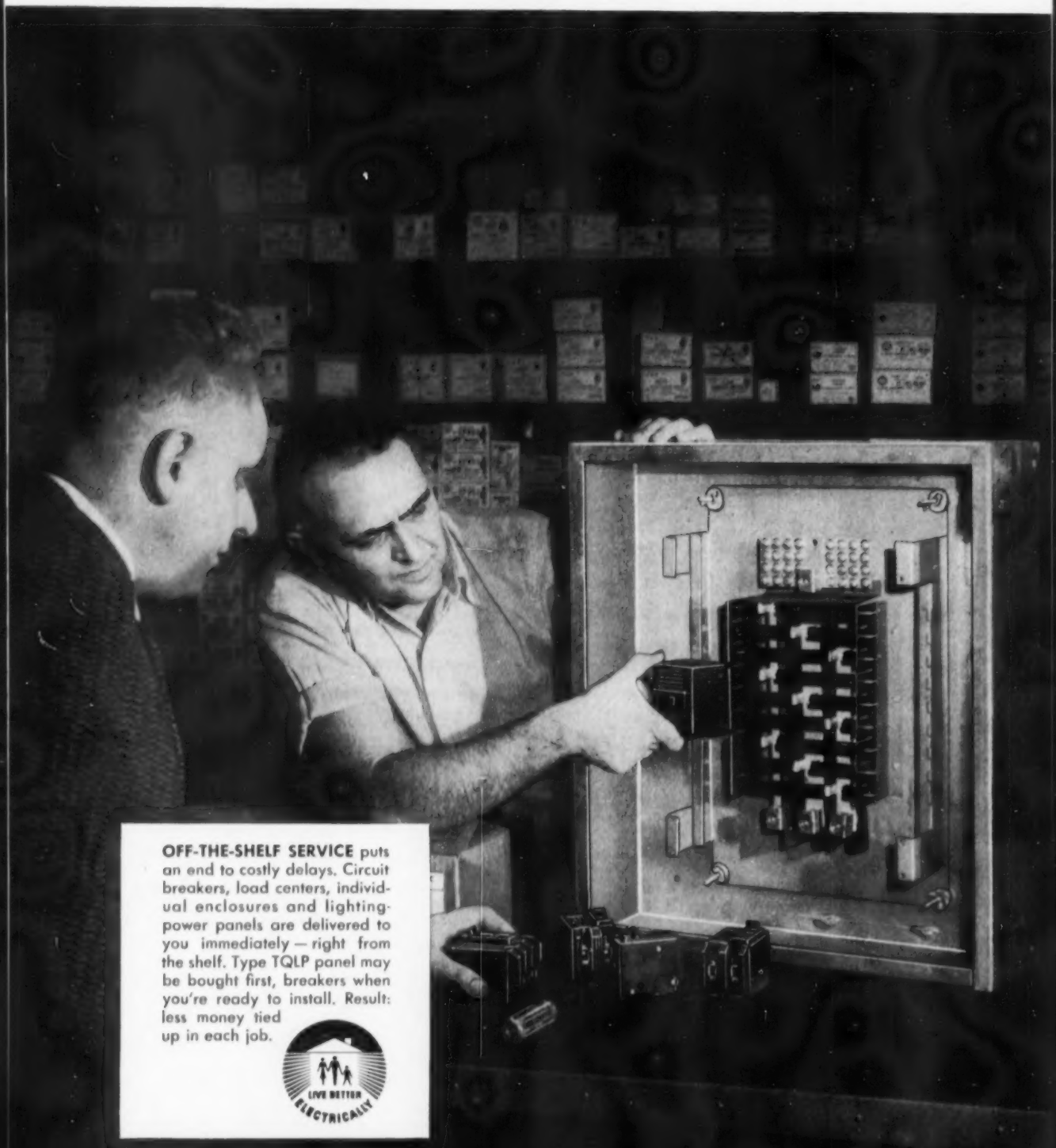
Now! at less cost to you plug-in power panels



OFF-THE-SHELF SERVICE puts an end to costly delays. Circuit breakers, load centers, individual enclosures and lighting-power panels are delivered to you immediately — right from the shelf. Type TQLP panel may be bought first, breakers when you're ready to install. Result: less money tied up in each job.

LIVE BETTER ELECTRICALLY

new General Electric off distributors' shelves!

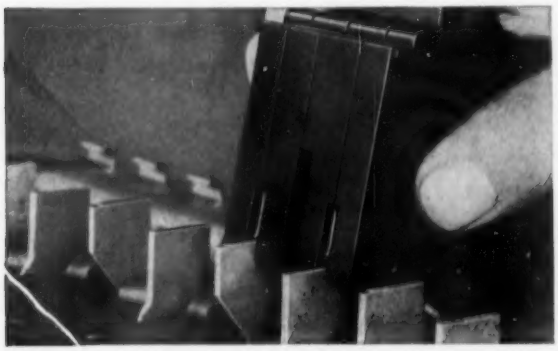
'Over-the-counter' lighting and power panels with General Electric's new 3-pole Type TQL circuit breaker reduce job time 25%

Thanks to General Electric's new 3-pole, plug-in breaker, you can now get "over-the-counter" panels that take *both* lighting and power circuits.

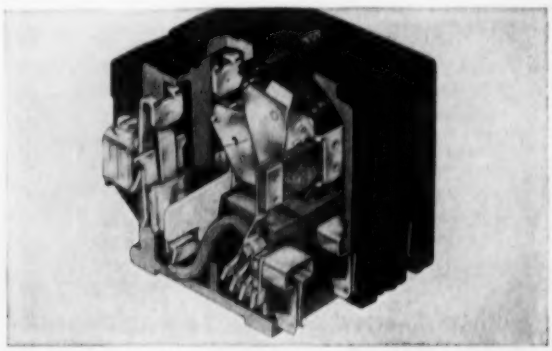
Here's how you save: Known as Type TQLP, the new G-E plug-in panels for lighting and power circuits cost up to 10 percent less than straight lighting panelboards . . . *up to 25 percent less* than bolt-in panelboards! Also, a lighting and power panel combination takes you about one-third less time to install than individual lighting and power panelboards. And contractors who stock their own breakers and panelboards can now carry fewer parts to do the same jobs.

One line of plug-in breakers can be used in seven different G-E devices. The new 3-pole breaker is only one-third the size of the E-frame breaker. It is interchangeable with General Electric's regular single- and 2-pole Type TQL breakers. In fact, the new three-pole breaker may be used in any of seven different G-E load centers and panelboards presently employing the TQL breaker. All breakers are rated up to 50 amperes. Devices accepting from 2 to 54 poles have mains rated up to 600 amperes.

Ask your G-E Distributor to help you figure the low-cost way to buy and install the new plug-in power panelboards on your next job. *General Electric Company, Plainville, Conn.*



Circuit breakers plug in easily and securely to load center and panel bus. Self-aligning, silver-plated copper pressure contacts assure positive contact and long life. Contact pressure is maintained by spring-steel clips which provide electrical contact equal to bolted joints.



Quick-make, quick-break contacts can't be teased in or out. Common-trip action on all 2-and 3-pole breakers. The new 3-pole TQL breaker meets the same Underwriters' Laboratories, Inc., standards as the the E-frame breaker, yet is only one-third the size.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Don't worry about the ELEPHANT . . .

HE'S ON A

BAKER SCAFFOLD

No, Baker Scaffolds aren't designed for elephants. But they are designed for loads up to 800 pounds with a safety factor of 4. The strength and stability is always there in greater amounts than the loads that are put on them.

Absence of X-Bracing permits easy spanning of intervening objects, giving a great variety of uses. And they are easily and quickly set up or taken down. Mounted on casters, the Baker Scaffold is easily moved anywhere, through doorways, down halls, to the job to be done.

The Baker Scaffold can help you with your job, too. Write for Bulletin 573.

Listed under Reexamination Service Underwriters' Laboratories, Inc.

Distributors in Principal Cities

BAKER-ROOS, INC.

P. O. Box 892, Indianapolis 6, Indiana

BAKER-ROOS, INC. ECM
P. O. Box 892, Indianapolis 6, Indiana

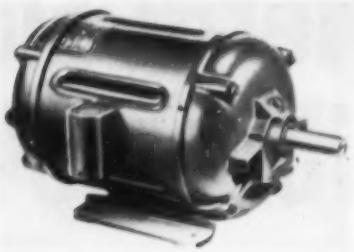
Gentlemen: Please send me full details and photos of Baker Scaffolds in action without obligation.

Name .....

Business .....

Address .....

City ..... State .....



Motor **(37)**

Repulsion-start induction single-phase motors, in integral horsepower 4-pole ratings 1 through 5 hp, are now being built in NEMA frames 182 through 254U. Placing these motors in the new frames, making them interchangeable with capacitor-start and small polyphase motors of the same ratings, was accomplished without changing their electrical characteristics.

Wagner Electric Corp., 6400 *Plymouth Ave., St. Louis* 14, *Mo.*

Fluorescent Lamp **(38)**

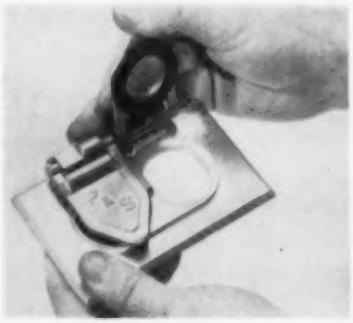
Fluorescent tube emits a soft, pastel green light, scientifically engineered to follow the findings of the Hecht and Williams Eye Sensitivity curve. Niletone Louvre-Lites are for use in drafting rooms, typesetting and stripping, drawing rooms, offices, all precision work, etc. All tubes are guaranteed. Each tube is code dated when shipped.

Nu-Lite Corporation, 41 *South 6th St., Newark, N. J.*

Dimmer Switch **(39)**

Developed to meet the higher wattage requirements of many residential and commercial lighting circuits, dimmer switch WBD750, provides full dimming, brightening, and blending for 750 watts of incandescent, or 12 40-watt rapid start fluorescent lamp loads. Wallbox is 5¼ in. wide, 7¼ in. long and 5⅞ in. deep to fit 6-in. wall. Steel faceplate is 7⅛ in. wide. and 8¾ in. long. Knobs are available in either ivory, black or gray. Except for fluorescent lighting circuits, no external switch is required. An input switch automatically disconnects the unit and load when turned in "off" position. A thermal overload relay and fuse link protect unit from overloads.

Superior Electric Company, Bristol, Conn.



Receptacle Cover **(40)**

Spring door receptacle cover for industrial plants, garages, creameries, distilleries, breweries, loading platforms, and residences is completely watertite, rustproof, and weatherproof. The 4500 unit features two hinged covers. When one half of the outlet is in use, the other half is closed securely. The covers snap shut automatically when caps are removed. There are ⅛ in. ridges formed on the plate and on the inside rim of each cover. These ridges bite into rubber gaskets to form watertite seals.

Pass & Seymour, Syracuse, N. Y.

Connector **(41)**

Aluminum 2-bolt clamp includes a spacer with wrap-around finger, enclosing the conductors over the fittings entire range. The greater contact surface gives increased conductivity and grip, and minimizes cold flow of the cables. It is a one piece fitting, as the long bolt is staked, and short bolt has a retainer washer.

Penn-Union Electric Corporation, Erie, Pa.

Rubber Tape **(42)**

Slipknot Brown splicing compound, a new rubber tape with characteristics exceeding ASTM electrical specifications, is now available. The tape is packaged in 25-ft rolls, ¾ in. wide. The tape carries U.L. approval.

Tape Division, Plymouth Rubber Company, Inc., Canton, Mass.

service drop

New Self-Fusing, All-Weather SPLICING TAPE scores solid hit

At last! . . . an all-weather, self-fusing, flame-resistant splicing tape is on the market. This new, multi-purpose tape is already generating wide acceptance . . . the only self-fusing tape listed by the Underwriters' Laboratories for use as "sole insulation and covering of splices and joints in electrical conductors."

OKOWELD rapidly fuses into a solid, weather-resistant wall. It serves as *both* insulation and sheath on cables for operation up to 2000 volts . . . cannot unwrap or separate into layers like "adhesive" tapes.

Electrically strong, **OKOWELD** has excellent resistance to water, weather, ozone, chemicals, oils and most hydrocarbons.

OKOWELD's toughness makes it ideal for portable cables on rugged jobs . . . and it passes the Bureau of Mines Flame Resistance Test.

OKOWELD is easy to apply . . . either side is "up" . . . shapes smoothly over irregular surfaces . . . use in coldest weather.

Non-sticky, non-brittle, using no adhesives, **OKOWELD** is the "thousand-uses" splicing tape that never sits in the electrician's tool box waiting for a job. Ask your distributor for full facts today or write to The Okonite Company, Passaic, N. J.

portable cables

phase color coding

Sold only through authorized distributors

OKONITE SPLICING TAPES

5265

KRAEUTER has done it again. Now for the first time you can secure comfort and color along with KRAEUTER quality at no increase in cost.

Every KRAEUTER solid joint plier has a cushion grip of thick vinyl to make your tough jobs easy. All KRAEUTER "CG"* cushion grips provide easy identification—easy to locate in your tool box—ideal for departmental color coding in your plant. All KRAEUTER "CG"* cushion grip pliers assure you comfort and ease on the job.

Whether you use side cutters, diagonals, lineman's or one of the other quality pliers in KRAEUTER's long line, you will find "CG"* cushion grips a standard feature at regular prices.

Ask your distributor for KRAEUTER "CG's"* today and put ease in your work.

*CG Cushion Gripped Pliers

BUY THE FINEST

BUY KRAEUTER BUY AMERICAN

AS MODERN AS TOMORROW

kraeuter & co., inc

FOR 100 YEARS THE FINEST IN HAND TOOLS 1860-1960 NEWARK, N. J.

High Bay Lighting (43)

Par-Beam-Lite canopy units for high ceiling lighting applications provide high intensity adjustable floodlighting at distances up to 100 ft. Each unit is supplied with Shur Mount plate for secure attachment to 4-in. and 5-in. boxes. Louvers and color lenses are available. Applications include department stores, auditoriums, gymnasiums, museums, hangars, and industrial plants. Fixture is made with patented spring-tension socket which adjusts to any position and will stay put at any angle.

Swivelier Company, Inc., 43-34th St., Brooklyn 32, N. Y.

Radiant Heat Baseboard (44)

Available in 600-, 1000-, and 1500-watt ratings, these radiant heat baseboards utilize the recent "Amp-Quartz" element reported to have a radiation efficiency of over 91%. All models may be used on either 120- or 240-volt circuits and are controlled by an individual thermostat in each room. The units measure 2 in. wide by 8 in. high, may be painted to match room decorations and are claimed to be maintenance free.

Ampere Industries, 60 Boston Street, Newark 3, N. J.

Ballast (45)

Mercury lamp ballasts have been developed that are impervious to any moisture damage in pole base installations. It contains an aqualift sealant that retains its sealing properties through extreme heat and freezing cold. It also prevents "breathing" through sudden temperature changes, and maintains air and moisture-tight closure around and between leads and nipple tunnel. The ballast has been tested in and out of water, including complete submersion under extended life test without a single drop of moisture breaking through.

Jefferson Electric Company, Bellwood, Ill.

Silver-dot

THE MOST EFFICIENT ALL-PURPOSE DOWNLIGHT FOR ALL RESIDENTIAL and COMMERCIAL APPLICATIONS

LAMP COST *at one-third of other units*

Silver-Dot units use low cost silvered bowl lamps. The lamp renewal cost for equivalent burning hours is approximately ⅓ that of equipment using reflectorized lamps. In addition, the labor cost of replacement is reduced because all Silver-Dot units can be relamped with pole type lamp changers.

POWER COST *at two-thirds of other units*

Many recessed downlights are designed for 150W lamps. Silver-Dot 100 Watt units therefore require just ⅔ as much electricity.

LIGHT OUTPUT *of three times other units*

Silver-Dot line units will provide up to 3 times as many foot-candles as other units of similar application. This impressive increase in illumination is more precisely controlled with less objectionable glare from the unit itself

ADAPTOR TYPE SILVER-SPOT

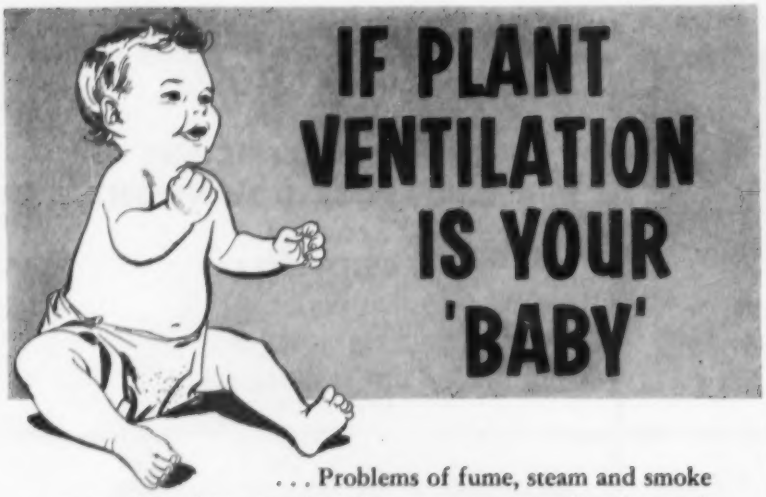
Designed for use in any porcelain receptacle or swivel fitting as an effective and inexpensive way of providing supplementary or special effect lighting. Colored light available with interchangeable color reflectors

Send for your FREE

SILVER-DOT OPERATING COST COMPARATOR

Provides relative operating cost (Lamp renewals and electricity only) per lumen delivered for 1000 hours of operation for several types of downlights tested under identical conditions. Send request on letterhead to

SKYLIKE LIGHTING, INC.
A SILVRAY ASSOCIATED COMPANY
BOUND BROOK • NEW JERSEY



IF PLANT VENTILATION IS YOUR 'BABY'

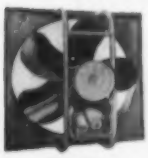
. . . Problems of fume, steam and smoke removal land in your lap. Some areas are too hot for peak work efficiency—fresh air has to be moved into every part of the plant—perhaps humidity control is important or paint booths have to be ventilated . . . You may have any number of different problems, but . . .

Power Line

CAN PROVIDE EVERYTHING . . . FROM SURVEY TO COMPLETE INSTALLATION!

For over 30 years we have been fan specialists. We can effectively assist in the design of a complete plant ventilating system or a spot cooling device. Furthermore, we are not limited in our recommendations because we have over 1000 models and sizes in our line to choose from . . . virtually every type of fan and ventilator that you could possibly use.

Use Power Line's Engineering Experience



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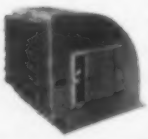


Power Line engineers can provide practical solutions to any ventilating problem . . . We'll gladly make a survey and make our recommendations without cost or obligation—just call or write us!

DOME TYPE

AD NO. 59-35

Power Line FAN COMPANY
PLAINFIELD, NEW JERSEY

Fluorescent Fixture **(46)**

Fluorescent fixture, designed to meet the current trend to wide, shallow luminaires, has high direct component of light. The completely metal enclosed fixture blends to any surroundings, is versatile in design and easily maintained. Surface or recessed mounting is available. The louvers, baffle type, provide 35-35 shielding, are held firmly in place by means of one positive action latch per louver section, so that no portion of the fastening device is visible on the exterior surface.

Fluorescent Fixtures of California, 352 Shaw Road, South San Francisco, Calif.

Transformers **(47)**

Rated at 3, 5, 7½, and 10 kva, these new series of Class H insulated, dry type transformers have been designed for lighting applications in circuits of up to 600 volts. Claimed to draw exceptionally low exciting currents, the new transformers have high temperature resistance, moisture resistance, and chemical stability. The units are mounted in boxes having removable front panels to facilitate access to the clamp type terminals, and quiet operation is obtained by elastically suspending the core and coil assembly.

R. E. Uptegraff Mfg. Company, Scottdale, Pa.

Fluorescent Fixture **(48)**

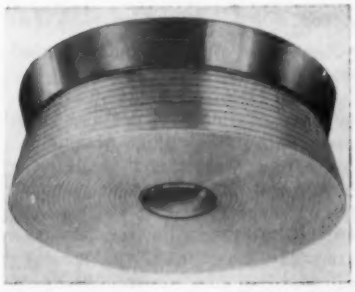
A new series of 3½-in. deep fluorescent lighting fixture features one-piece wrap-around plastic shielding, and one piece welded body. Designed for surface or pendant mounting. The shielding is made of extruded ever-white polystyrene. Wrap-Around Plastoliers are made in 4-ft lengths, 2- and 4-lamp rapid start, for individual installation or continuous runs.

Metalcraft Products Company, Inc., Philadelphia, Pa.

Mercury Lamps (49)

Five new 400-watt mercury lamps are designed to withstand the shock of exposure to cold water and snow when lit. Weather-resistant glass used in the outer bulb makes it possible for them to survive greater thermal shock without breaking. They are expected to be especially useful for gas stations, parking lots, and other types of outdoor lighting. They can be used outside in open type fixtures. The lamps have an economic life of 6000 hours with initial lumen output ranging from 18,000 to 22,000 depending on the type.

General Electric Co., Nela Park, Cleveland 12, *Ohio*



Utility Fixture (50)

"Companion" set of lighting fixtures has been introduced into the home lighting field. It may be utilized for twin lighting in kitchen-dinette areas. The fixture is available in both three and two lite combinations. Both fixtures are of modern design, with non glare white opal glass and an overall drop of 4 in. The 12¼-in. fixture, known as No. 910 will take up to three 60-watt lamps. The 9-in. No. 912 uses two 40-watt lamps.

Markstone Manufacturing Co., 1531 *Kingsbury St., Chicago* 20, *Ill.*

Receptacle (51)

A new line of 3-wire, 15-amp, grounding purposes only, features elbow shaped grounding slot. Device eliminates the danger of mistaking single-phase plus ground for a three-phase circuit. The line consists of: a duplex receptacle, a connector body, and three caps, rubber, bakelite, and armored. The units are non-interchangeable with regular "Twist-Lock" units. The receptacle is supplied with pressure grip back wiring, as well as conventional side wiring. U.L. approval.

Harvey Hubbell, Inc., Bridgeport, Conn.

QUAD
SIGN REFLECTORS

Quality

••THAT IS RIGHT FOR ANY SIGN
— any location — any condition

Rectangular Sign Reflector

● Widely used for wall signs and bulletin boards, these reflectors produce a uniform distribution of light over a wide vertical area. The contour is such that a straight line cutoff of light at top of sign is obtained without spillage, scallops, or shadows. Sizes range from 50 Watts to 1500 Watts.

Spade Sign Reflector

● Designed for small and medium sized signs this unique one-piece reflector is ideal for store-front transoms. Streamlined, yet inconspicuous, it does not obstruct view of sign. Rust-proof, weather-proof, easy to wire, it mounts on a shorter ½" pipe arm. Light distribution is wide on the sign with straight line cutoff at upper edge. Has two socket positions for 60 watts to 150 watts.

Round Angle Sign Reflector

● Generally used for gasoline station advertising, these efficient reflectors are in service everywhere—lighting all kinds of signs from "Tourist Rooms" to full sized bulletins. The forty-five degree axis of light distribution insures proper lighting at the bottom of the sign. Sizes range from 40 Watts to 500 Watts.

Reflectors are removable and interchangeable on all three types of socket-fittings. Easy wiring and installation features making them especially suitable for sign work are shown in the sketches at right.

The QUAD line of sign lighting reflectors includes a total of fifteen different sizes and shapes ranging from six inch round for 40 watt lamps to eighteen inch rectangular for 1500 watt lamps. Whether the job is large or small there is a QUAD reflector that fits. All are finished in permanent porcelain enamel — green or white outside with a lustrous white inside reflecting surface. Fittings are cast aluminum.

SPECIAL FEATURES

In addition to the type "H" socket-fittings for attaching to horizontal pipe shown on the round and rectangular reflector pictures, there are also available "V" fittings for suspending reflectors on vertical pipe and "B" socket-fittings for mounting direct to outlet box.

OUR 36TH YEAR
● SOLD THROUGH ELECTRICAL WHOLESALERS

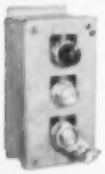
QUADRANGLE MFG. CO.
32 S. PEORIA ST. CHICAGO 7, ILL.

YOU SAVE 2 WAYS WITH the right control

There is a right control for every job. By using Furnas Electric controls, cost and space advantage can be yours. Designed for the motor, these controls can save you up to 25% in cost and 40% in space.

Furnas Magnetic Starters are available through Size 4 in 10, instead of the usual 5, different sizes from 1 to 100 hp. This provides "In-Between" sizes, not otherwise available, at corresponding price and space advantages.

Drum Controllers—over 1000 models available from 1 to 10 hp for whatever application you require. The durability, ease of operation, versatility and low cost of drum controllers make them adaptable to the majority of applications satisfied by manual control.



Oil Tight Push Buttons for every need. Standardization and interchangeability mean more combinations with fewer parts. Complete accessory line.

Pressure Switches

Limit Switches

Foot Switches

For more information write for Bulletin 5411E.
1067 McKee Street, Batavia, Illinois

A35

FURNAS

FURNAS ELECTRIC COMPANY
BATAVIA, ILLINOIS
SALES REPRESENTATIVES IN ALL PRINCIPAL CITIES

Connectors (52)

These compression connectors may be used to splice both aluminum and copper conductors thus making it unnecessary to stock two different types of connectors. Made of high conductivity aluminum, the connectors have a hot-tin coating which prevents electrolysis and eventual joint failure. The new line consists of one-and-two-hole lugs and two-way connectors from No. 8 AWG to 1000 MCM. Each connector size from No. 8 to 3/0 is color-keyed to a die in the new TBM 5 hand tool. Sizes from 4/0 to 1000 MCM are installed with a hydraulic tool and are also color-keyed to their respective dies.

The Thomas and Betts Company, 36 Butler St., Elizabeth, N. J.

Motor (53)

New line of Model R re-rated fractional horsepower motors. Designed in NEMA frames 56 and 48, they are available in ratings from ½ to 1 hp in polyphase, capacitor single phase, permanent split capacitor and (in the smaller ranges) split phase type. A redesigned ventilating system has helped make it possible to put many ratings usually expected only in the 56 frame into the smaller 48 frame. The terminal box is built into the lightweight die-cast aluminum head. Terminal board is mounted close to the cover. The motors are built with either rigid, welded base or with vibrationless, resilient mounting.

Robbins & Myers, Inc., Springfield, Ohio

Product Briefs

(54) Pattern Products, Union, N. J., has developed a fluorescent **tube changer** made of aluminum and capable of being adjusted to almost any reasonable height. . . . (55) A **pipe and bolt machine** made by Beaver Tools, Inc., Warren, Ohio, features a new Universal-type die head which has three sets of high speed steel dies and threads from ½ in. to 2 in. . . . (56) A new **tool** used to drive studs and pins into steel, concrete, and brick, and to fasten light construction materials to such hardware has been developed by Fastway Fasteners, Inc., Lorath, Ohio.

(57) Stahlin Brothers, Inc., of Belding, Mich., has announced a new type of **wiring raceway** designed to facilitate control panel assembly by eliminating wire bundling and lacing operations and

by not requiring threading of the wires through the raceway openings. . . . (58) Wire connector joints are quickly tightened with the new **wire connector wrench.** Made by Holub Industries, Inc., Sycamore, Ill., the wrench fits two sizes of wire connectors. . . . (59) The Steelduct Company of Youngstown, Ohio, is producing a new type of E.M.T. having a lateral blue line on each length to permit precise bending. Called "Bend-Aliner", the new **tubing** can be used with any bender marked with a new 90 degree center line.

(60) Porter-Cable Machine Co., Syracuse, N. Y., has announced a new 3.8 in. **drill** capable of performing all types of drilling operations in wood or metal. About the size and weight of an ordinary hand-drill, the model 149 has added power and larger chuck capacity than an ordinary ¼ in. drill. . . . (61) A new multiple purpose and lightweight **saw** able to cut a wide range of materials has been introduced by the Porter-Cable Machine Co. of Syracuse, N. Y. and features orbital action of its blade. . . . (62) An extra heavy duty ½ in. **drill** able to meet the requirements of continuous industrial use and featuring an adjustable rear handle to facilitate its use in tight spots is being made by Portable Electric Tools Co., Chicago, Ill.

(63) Cummins Portable Tools Co. of Milwaukee, Wis., is manufacturing a new **sanding machine** which provides two types of sanding action in one piece of equipment. By a simple turn of a directional switch, the sander motion is changed from standard sanding operation to fine finishing action. . . . (64) A new vertical **drill press** which features a lock lever on the drill carriage requiring no wrench has been announced by the Cummins Portable Tools Co. of Milwaukee, Wis.

(65) Momentary contact rectangular **pushbuttons** for individual and multiple application are now being made by the H. R. Kirkland Co., Morristown, N. J. The units feature an integral identification area and are available in black, red, white, and green on a black frame. . . . (66) "Homelight" is the name given by General Electric Co., Cleveland, Ohio, to fluorescent **lamps** which have been newly identified to facilitate selection by the home user.

- **Easy to install...simple to service!**
- **No troublesome protective relays!**
- **No flashing contactors!**
- **No complicated electronic adjustments!**

Specially designed for machines where friction or torque is constant from high to low speed. Motor-generator set, controller and drive motor can be mounted independently, in any position.

- *One* control for all adjustments. 0 to 2400 RPM in 30 steps of 80 RPM, forward or reverse.
- Totally enclosed Streamcooled construction . . . vernier rheostat for infinite speed control between steps . . . jog switch for machine adjustments . . . reversing switch changes rotation . . . many other features.
- Ideal for use on conveyors, pumps, mixers, shaker screens, packaging machines, fans and blowers, farm machinery, governor controls, similar machines.

For complete engineering data write for Bulletin SP-600

BALDOR ELECTRIC COMPANY
4353 DUNCAN AVE. ST. LOUIS 10, MISSOURI

CLARK-AMERICAN SERVICE ENTRANCE EQUIPMENT

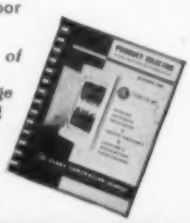
• More and more contractors insist on using Clark-American Service Entrance Equipment because it saves them time and cost on house wiring jobs. They know, too, that once installed it can be counted on to give dependable, trouble-free service, avoiding costly repair calls.

The fact is that every construction detail has been carefully planned to make installation faster and easier. And every step in production is rigidly controlled to maintain Clark's high quality standards.

FEATURES INCLUDE:

- Baked-on grey enamel finish
- One-piece trim and door
- Cover easily removed
- Plenty of knockouts, conveniently located
- Knockouts easily removed
- Generous wiring space
- Slotted upper mounting holes
- Solderless lugs on line, range and sub-feed terminals
- Wire-binding screws on plug fuse terminals
- 100 Ampere capacity plated line lugs
- Non-interchangeable pullouts
- Wiring diagram inside door

Write for your free copy of the CLARK-AMERICAN *"Product Selector"—32-page book with complete catalog plus application and installation data.*



American
ELECTRIC SWITCH DIVISION

The CLARK CONTROLLER Company
Engineered Electrical Control • 1146 East 152nd Street • Cleveland 10, Ohio

CATALOGS and BULLETINS

(67) DISTRIBUTION TRANSFORMERS for rural and industrial substations, 75 through 500 kva, 67 kv and below, single phase. 16-page bulletin. Allis-Chalmers Mfg. Co.

(68) UTILITY FANS and mancoolers; heavy-duty all-purpose units for spot cooling, drying, or processing, with two, four or six blades, in sizes from 16 to 48 in. 4-page Bulletin 250-A. Aerovent Fan Co., Inc.

(69) TRANSFORMER BRACKET for mounting transformers from 3 to 167 kva on poles from 6½ to 16 in. in diameter. 4-page bulletin illustrates component parts, assembly procedure, and adjustments. Hubbard and Co.

(70) INDUSTRIAL WIRING DEVICES and explosion-proof products. Complete 68-page catalog and price list pictures and describes line of plugs and receptacles, fittings, junction boxes, cord grips, and other electrical materials. Ralco Mfg. Co.

(71) MULTIPLE OUTLET Data Sheet A-11 gives three solutions to problem of providing outlets for typewriters and business machines in various office and classroom layouts. The Wiremold Co.

(72) PORTABLE TIMERS and time switches for use in industry and the home; coin meters for use where metering and payment is required for public use of electrical equipment. 4-page Bulletin illustrates and describes equipment. M. H. Rhodes, Inc.

(73) POWER PLANTS, diesel-driven, for power and light applications. Specification sheets show output and engine speeds for models of 10, 15 and 20 kw capacity and list standard and optional equipment available. Universal Motor Co.

(74) VARIABLE VOLTAGE ADJUSTOR Catalog VA 312 describes voltage-regulating transformers set to cover a primary range of from 65 to 145 volts with output of 115 volts, plus a power voltage series covering a primary range of from 145 to 240 volts with a 115-volt output. Catalog also discusses problems of voltage drop and voltage fluctuations due to overloads on systems. Acme Electric Corp.

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Person in charge of electrical work is .....

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(75) SOUND FILMS catalogue illustrates and describes 47 general interest and product information films dealing with electricity and electrical equipment for use by professional or social groups for training or entertainment purposes. Westinghouse Electric Corp.

(76) UTILITY BLOWER SETS are described and illustrated in new 52-page catalog, covering such points as space volume, quantity of fresh air required, motor horsepower, fan speed, and duct sizes, plus typical specifications. American Blower Division of American Standard.

(77) POWER UNITS available for operation on natural gas, LPG, kerosene, distillate, or gasoline are described in two catalogs CR-510-G and CR-511-G, including dimensions, brief specifications, and performance data. International Harvester Co., Construction Equipment Div.

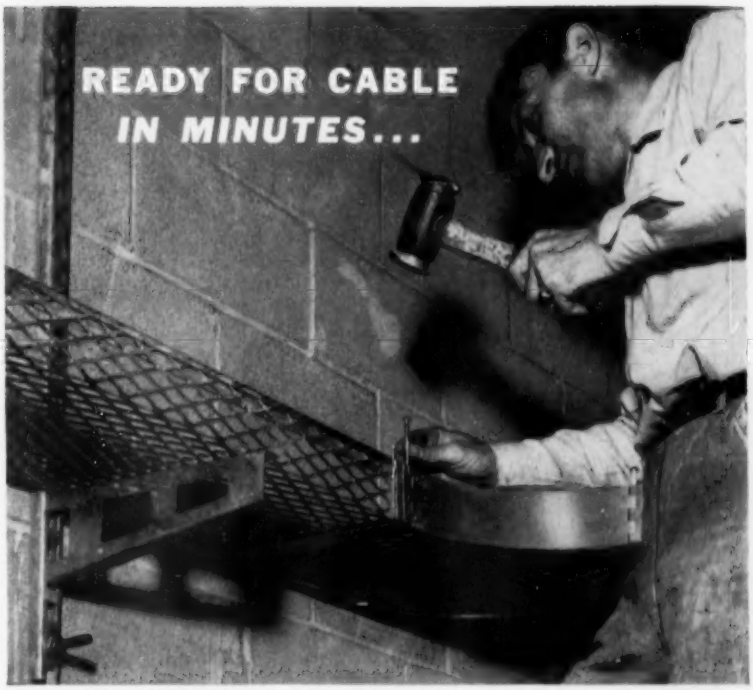
(78) MERCURY PLUNGER RELAYS for use on air conditioning and heating equipment, alarm and call systems, or motor and lighting control. Engineers' Fact File includes load ratings, contact data, coil characteristics, mounting dimensions, diagrams and illustrations. Ebert Electronics Corp.

(79) WEATHERTIGHT DOWNLIGHTS for installation in either concrete pourings or plaster ceilings. Folio 57-5 illustrates units for typical locations such as canopies, shower rooms, vestibules and marquees. McPhilben Mfg. Co., Inc.

(80) GEARMOTORS and package drives of horizontal, vertical, right angle, open, enclosed, and explosion-proof construction. Both ac and dc units are illustrated with their reduction ratios and output speeds in 8-page booklet DB-3650. Westinghouse Electric Corp.

(81) THERMOSTATS. Bulletin RT-802, 4 pages, describes new single-pole, single-throw, reverse-acting unit for air conditioners, refrigeration, and heater applications; 4-page Bulletin RT-110 contains data on a direct-acting and a reverse-acting thermostat suitable for a variety of commercial and industrial equipment. Robertshaw-Fulton Controls Co.

(82) LOW-VOLTAGE CONTROL of lighting and appliance loads in residential, commercial and industrial installations. 12-page manual discusses system advantages, includes wiring diagrams, photos of components, and typical specifications. Square D Co.



An aluminum coupler plate and two steel pins do the job—with Cope's patented pin-type coupler.

COPE CABLE TROUGH CUTS LABOR COSTS TO A FRACTION!

Three simple parts—an aluminum coupler plate and two steel pins—are all it takes to connect complete sections of Cope cable *trough* . . . and in less than half the time required to connect two lengths of conduit. Furthermore, because each 24" width of trough supports as much cable as *sixteen* lengths of 4" conduit, you can sometimes actually reduce labor time *and costs* by almost 60% for the complete job!

Space Saving Flexibility. Design and construction features of lightweight, easy-to-handle Cope cable supporting equipment speed installation of space saving systems—even in the most cramped quarters.

A complete line of system accessories and fittings allow for necessary changes in direction or elevation. Supporting riser elbows, trough to box connectors, and drop outs provide maximum flexibility of installation to meet system requirements . . . reduce design time up to 25% for laying out your system.

Cut Costs Three Ways. You save *three ways* when you specify Cope cable supporting systems with pin-type coupler . . . trough, ladder, or channel.

- **LOWER FIRST COST**
- **LOWER INSTALLATION COSTS**
- **LOWER SYSTEM MAINTENANCE COSTS**

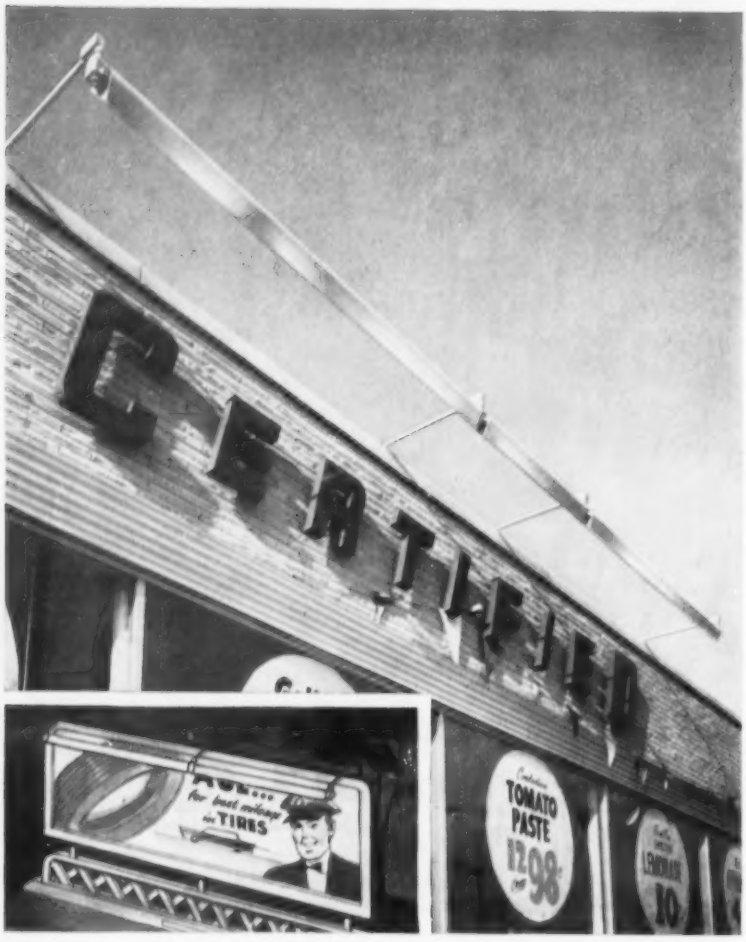
Discuss these advantages for *your* installation with a qualified Cope representative—or write to T. J. Cope Division, Rome Cable Corporation, Collegeville, Pa.

1001

T. J. COPE *Division*

ROME CABLE CORPORATION

New Revere Fluoresign Outdoor Luminaire



Now—high level illumination for poster panels, walls

Better light distribution, simplified installation, and flexibility to fit any display are three good reasons for specifying Revere's Fluoresign Outdoor Luminaire.

Fixtures employ fluorescent rapid-start lamps which provide 10 times the rated life of incandescent types . . . plus greater operating economy for low temperature outdoor use. New reflector design minimizes trapped light, and provides uniform light distribution.

Lightweight aluminum reflectors of 4, 6 and 8 feet may be assembled with end and center housing fixtures to any desired display length. Reflectors rotate in any direction — within full 360° — by simple screwdriver adjustments.

Write for complete bulletin No. 300-21 describing Revere's Fluoresign Outdoor Luminaire.

Revere ELECTRIC MFG. CO.

Revere Electric Mfg. Co.
6009 Broadway, Chicago 40, Ill.
UPtown 8-7100

Available in Canada thru Curtis Lighting, Ltd., Leaside, Toronto, Ontario

OUTDOOR LIGHTING: Industrial, Commercial, Service Stations, Streets, Sports, Airports, Shopping Centers

(83) WIRE & CABLE, connectors and wiring harnesses, portable spot welders and wire strippers, voltage testers, and commutator maintenance equipment are described and fully illustrated in new 20-page general catalog. Sittler Corp.

(84) GENERATING PLANTS in three general groups: ac, dc and battery-charging. New "Blue Book" traces history of electric plant development. D. W. Onan & Sons Inc.

(85) CHANNEL JOISTS for underfloor electrification. Brochure describes new shortspan open-web steel joists with the conventional top chord replaced by a hollow duct that serves both as a structural member and as an underfloor electrical distribution duct. Ceco Steel Products Corp.

(86) POWDER-ACTUATED TOOL code covering operation of the tool with maximum safety on the job, designed to serve as guide to agencies in creating regulations covering use of the tools. Powder Actuated Tool Manufacturers' Institute, Inc.

(87) ARC WELDERS rated at 300, 400 and 500 amps for dc or ac service are described in 4-page bulletin. Lincoln Electric Co.

(88) MULTI-OUTLET ASSEMBLY and surface raceway system. 4-page bulletin describes new Baseduct, complete with dimensions and assembly instructions and photographs. National Electric Products Corp.

(89) CLOSED-CIRCUIT TV is explained in a non-technical, step-by-step description by two new pamphlets. Included also are several budgets for educational distribution systems. Jerrold Electronics Corp.

(90) TEMPERATURE CONVERSION CHART gives easy-to-read tables of Fahrenheit and Centigrade temperature equivalents; may be carried in wallet or placed under glass desk top for ready reference. Moeller Instrument Co.

(91) FOOT SWITCHES in four classes: general purpose heavy duty, water-tight, explosion-proof, and high dc rated. Complete specifications for 40 models are given in new 4-page bulletin. Linemaster Switch Corp.

(92) AIR SWITCHES for high-voltage transmission circuits. 12-page Bulletin PSE2 presents all details of this vertical-break air switch, available for use with 600 and 1200 amps and with voltage ratings of 69H, 115 and 161 kv. Line Material Industries, McGraw-Edison Co.

(93) INDUSTRIAL TACHOMETERS. 12-page Bulletin GEC-1258A describes variety of generators and indicating or recording instruments available for measuring speed of rotating equipment. General Electric Co.

(94) ROTARY MASONRY DRILLS. 2-page bulletin describes carbide-tipped "Tip Top" drills for masonry drilling using standard rotary electric or air drills. Termite Drills, Inc.

(95) OIL CIRCUIT RECLOSERS. Catalog Bulletin CR1C contains information on application, design features, ratings, modifications and dimensions. Line Material Industries, McGraw-Edison Co.

(96) MOTOR CONTROL CENTERS. Booklet EL-174 describes Unitrol system of presenting a wide variety of motor control in a central structure. Cutler-Hammer, Inc.

(97) LIGHTING-TYPE BUSWAY, rated 50 amps at 300 volts, ac or dc, for use as a power supply for lighting fixtures, small power tools, and machines in industrial and commercial buildings. 12-page Bulletin GEA-6170 gives detailed application information and a brief description of new roll-in method of installation. General Electric Co., Distribution Assemblies Dept.

(98) ADJUSTABLE LIGHTING UNITS for "Trol-E-Duct" attachment or for flush ceiling attachment are illustrated and described in 4-page bulletin, complete with prices. Swivelier Co. Inc.

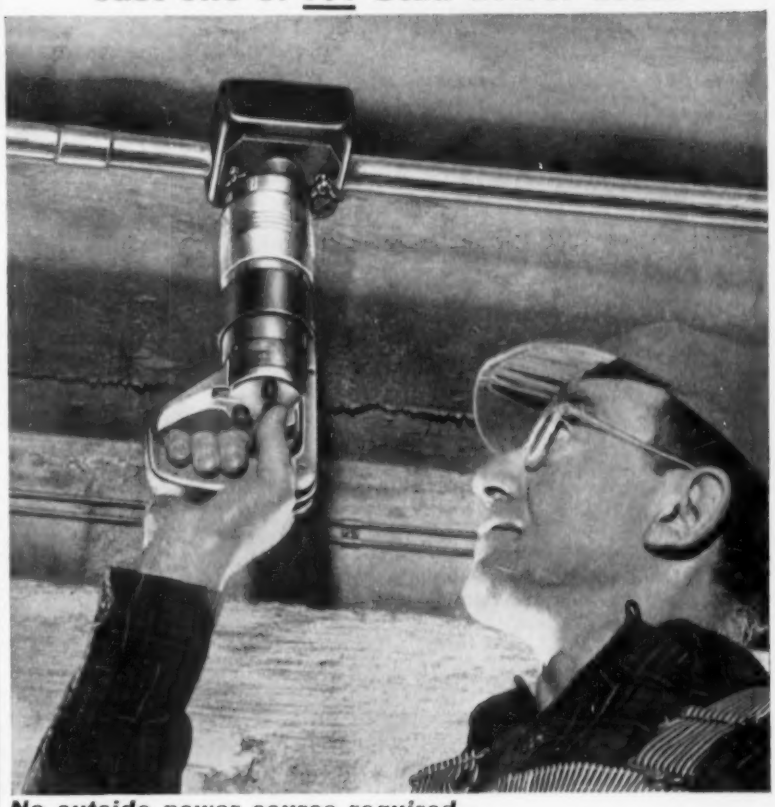
(99) LANDSCAPE AND PARKING LIGHTING, including walkway and shrubbery luminaire, parking area luminaire, pedestrian luminaire, poles and pole conversion units are described in new 4-page Bulletin No. 104. Philadelphia Electrical & Manufacturing Co.

(100) LIGHTING EQUIPMENT for industrial use. Incandescent and mercury vapor units are described and illustrated in new 12-page product information bulletin. Miller Co.

(101) MOTOR-DRIVEN TIMERS are discussed in two bulletins, PB-271 and PB-571. Time ranges, ratings, operation and application of a new interval timer and a cycle timer are given. Cramer Controls Corp.

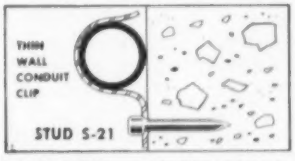
(102) ELECTRICAL FITTINGS, cable racks and wiring specialties for contractors, public utilities and industrial plants are described in new 36-page Catalog 57. M & W Electric Mfg. Co., Inc.

Just one of *101* Stud Driver uses!



No outside power source required—

Anchor conduit clips to concrete or steel in seconds with the Remington Stud Driver



REMINGTON CONDUIT CLIP is easily anchored to concrete or steel with S-21 Stud. Special Conduit Clip Guard instantly adjusts to size of pipe or conduit . . . assures accurate, arrow-straight placement of stud.

Now you can fasten conduit without hammering or drilling—thanks to the cartridge-powered Stud Driver! Just squeeze the trigger, and a metal stud anchors conduit with Remington Clip—thin or heavy wall, available in three sizes. The Stud Driver sets either ¼" or ⅜" diameter studs . . . up to six a minute. And barrel change-over takes just 90 seconds, *right on the job*. Over 40 studs to choose from, plus a selection of scientifically graded 22 and 32 caliber Power Loads give the flexibility you need for all light, medium or heavy-duty work.

SAVE TIME, CUT COSTS on every job with this modern tool. Coupon brings free booklet that shows how and where to use the Stud Driver.

Remington

DUPONT

STUD DRIVER

Industrial Sales Div., Dept. ECM-8
Remington Arms Company, Inc.
Bridgeport 2, Conn.

Please send me your free booklet which shows how I can speed the job and save with the Stud Driver.

*Name*_____ *Position*_____

*Firm*_____

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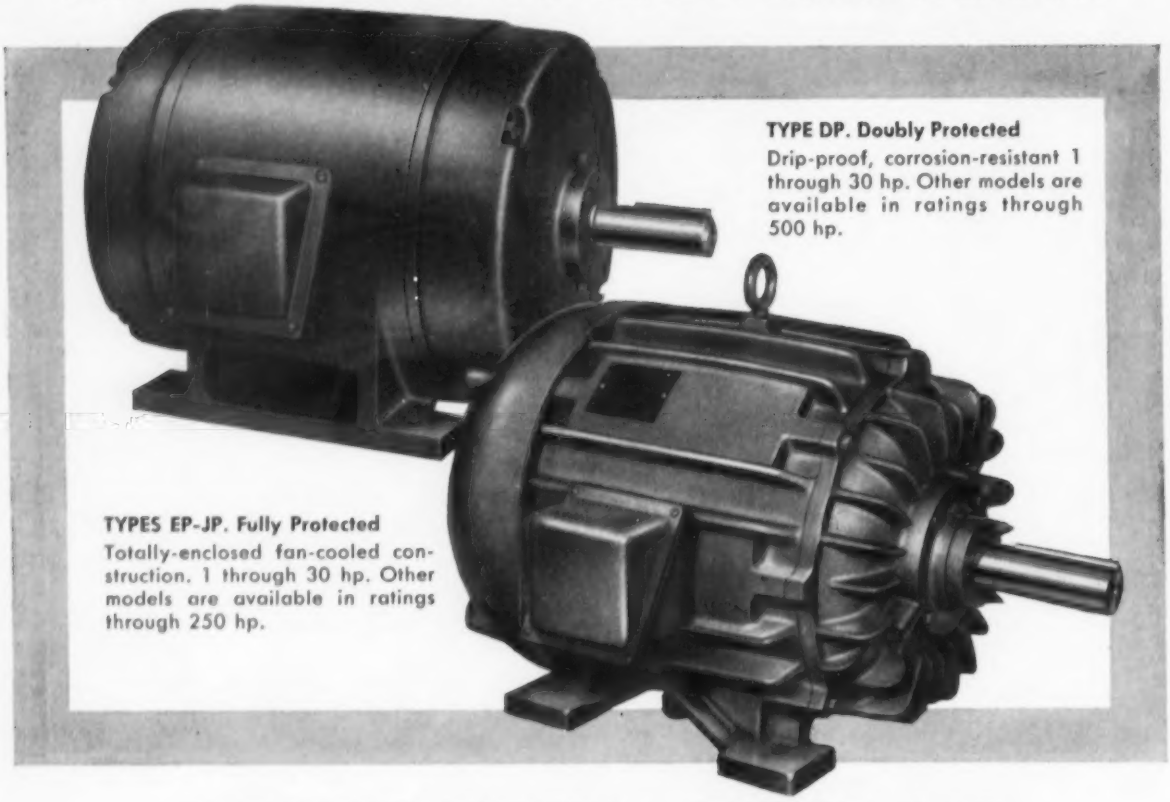
*City*_____ *State*_____


TYPE DP. Doubly Protected
Drip-proof, corrosion-resistant 1 through 30 hp. Other models are available in ratings through 500 hp.
TYPES EP-JP. Fully Protected
Totally-enclosed fan-cooled construction. 1 through 30 hp. Other models are available in ratings through 250 hp.

PRODUCTION GOES UP

when you power equipment with these Wagner Motors

Production is increased when motor down-time is reduced. To meet today's industrial demands for faster, more dependable production, Wagner has designed these industrial motors with *extra* protection that cuts time-out for motor maintenance to a minimum.

These motors pack more power in less space—1 through 30 horsepower in NEMA frame sizes 182 through 326 U.

EXTRA PROTECTION—Type DP is doubly protected by a rugged corrosion-resistant cast iron frame and by completely drip-proof enclosures.

Types EP and JP are totally enclosed against dust, grit, fumes or moisture—protected against corrosion by cast iron frames. Type JP is explosion proof as well.

COOL RUNNING—Both types are cool running. Blowers and special baffles direct cooling air through the DP motor. Types EP and JP are fan-cooled and are built with ribbed frames to increase the cooling surface.

LONGER BEARING LIFE—Original bearing lubrication will last for years in service under normal conditions, but openings are provided in the bearing housing to add fresh grease—remove old grease when required.

Let a Wagner motor application engineer show you how well these motors can fit *your* needs. Call the nearest of our 32 branch offices, or write us. Bulletins MU-202 and MU-203 give complete information on these Wagner Motors. Write for your file copies today.

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MS7-12

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Resistance Heating

QUESTION H32—Could some reader tell me how to apply electrical resistance heating to prevent freezing of water lines? Some of these lines have flowing water and some are static bypass lines and some transmit pressure to gauges. —H.G.R.

ANSWER TO H32—Calculations for the application of electrical resistance heating to pipes containing standing water and pipes transmitting pressure to gauges (neglecting error due to expansion and contraction in the pressure line) can be made in the following manner. In some cases, the formula given provides a practical approximation rather than exact theoretical value.

1. Total Heat Loss in Btu/hr $= A \times U \times (T_0 - T_1)$ where:
   A is the average of the total inside and outside areas of the thermal pipe insulation.
   U is the heat transfer coefficient of the pipe insulation $\left(\frac{k}{t}\right)$ or about 0.35 for 1 in. of insulation.
   T_0 is the minimum outdoor temperature in degrees Fahrenheit.
   T_1 is the minimum desirable water temperature in degrees Fahrenheit, say 40°.
2. Total Watts Required $=$
$$\frac{\text{Total Heat Loss in Btu/hr}}{3.413}$$
3. $$\left[\begin{matrix}\text{Length of Resistance Wire in feet required for two wraps per foot of pipe}\end{matrix}\right] = \left[\begin{matrix}\text{Length of pipe in feet}\end{matrix}\right] \times \left[1 + 4(\pi d)^2\right]$$
   where: d is outside diameter of pipe in feet.
4. Total resistance of wire $= \dfrac{(\text{voltage})^2}{\text{watts}}$
5. Choose a wire of the proper resistance per foot to provide the correct total resistance in the length as determined in step 3. It may be necessary to increase the length of wire or supply more than the minimum amount of heat required if a wire of the desirable resistance is not available commercially.
6. Wrap resistance wire over pipe in form of loop (for return circuit) with about 6 in. between individual wires. Apply thermal insulation over pipe and wire. Provide thermostatic control in outside air set to close on falling temperature at about 40° F.

The problem of determining the minimum amount of heat required for pipes containing flowing water is somewhat more complicated than for water standing in pipes. If the amount of heat entering the pipe is greater than the heat loss no protection is required. (Water contains one Btu per pound for each degree above 32° F.) The heat required to protect a pipe containing standing water will obviously protect a pipe containing flowing water. However, if the pipe is long, economics may dictate using the following method of calculation:

1. Total heat loss in Btu/hr $= A \times U \times$ (Average temp diff.) where A and U are same as in preceding step 1.
   (Avg. temp. diff.) $=$
$$\left[\frac{\text{Temp. entering pipe} + \text{temp. leaving pipe}}{2}\right] - \left[\text{Minimum outdoor temp.}\right]$$
2. All other calculations will be same as for pipes containing standing water.—W.A.G.

ANSWER TO H32—I have successfully heated pipes to prevent freezing by wrapping them with lead covered heating cable and controlling the temperature with a thermostat. The bulb of the thermostat is strapped directly to the pipe. Thermostatic control not only assures that the proper temperature is maintained to prevent freezing but also prevents excessive temperature rise which could damage the cable sheath. The pipe including heating cable and bulb can be covered to prevent excessive heat loss.

Soil heating cable is available in standard lengths of 30, 60, 120, and 240 ft for 110-, 220-, or 440-volt circuits. It is inexpensive and when properly installed is reliable and maintenance free.—R.E.B.

ANSWER TO H32—Resistance type heating cables are available for heating pipes. The cable suppliers publish data as to application, etc. In general, the method is to run the cable along the pipe and to "lag it in" by applying any of the commercial pipe insulations, which should have a watertight overall covering.

However, a much better method is to use the new commercial copper conductors identified as "Mineral Insulated Cable". General Cable is one of the prominent suppliers. This cable should be used to wind around the pipe in some degree of spiral. A single conductor cable should be used. The single copper conductor is insulated from the copper tube sheath by fused magnesium which will withstand all of the heat to be encountered. The cable should be secured in place and also "lagged in" by the overall application of a suitable weather resistant insulation.

Heat is generated directly in the steel pipe by eddy currents. These eddy currents depend upon the degree of magnetization set up in the steel pipe. Requirements can be quickly arrived at by tests, using a wattmeter to indicate the energy being dissipated in the cable and the pipe. All of the energy, the I^2R losses in the copper and the eddy current energy will be useful toward the end desired. This method has the distinct advantage that the whole pipe is warmed. A resistance wire type of heater would have extra delay due to heat transfer through the cable wall and into the steel pipe by conduction.

The designer can set up automatic controls by utilizing the heating cable, whichever kind is used, as a thermal sensing element for a resistance type thermometer set up. With the proper contactors, etc. the installation can be made completely automatic.

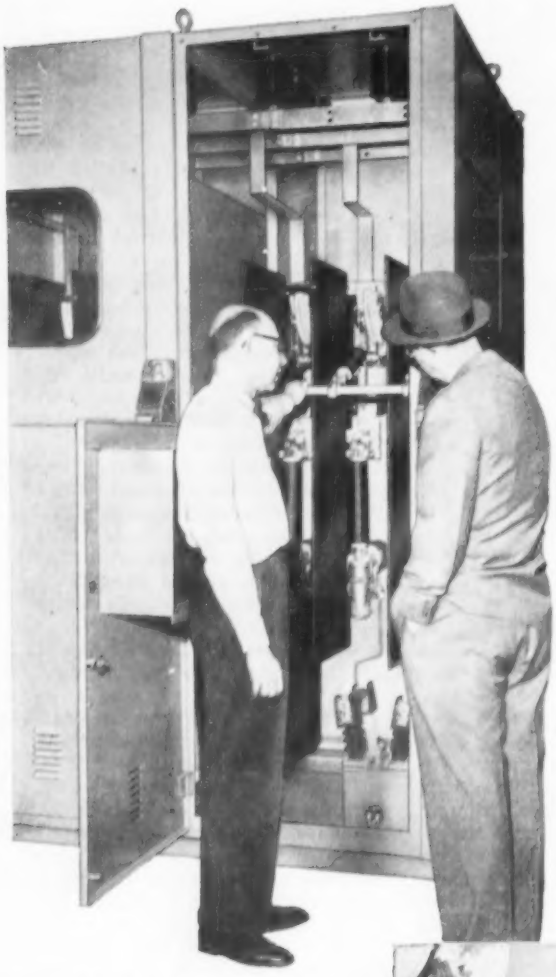
I know of one installation that is composed of single conductor No. 8AWG Mineral Insulated Cable wound on an asphalt line. Smaller sizes would be applicable in some instances; a matter of balancing the energy and the insulation against the weather at the particular job.—C.J.R.

System Grounding

QUESTION J32—In our plant we have a 440-volt ungrounded delta secondary distribution system. Will someone please explain how this system can be grounded as we feel that many of our motor burn-outs are caused by intermittent grounds on our system.—J.M.

ANSWER TO J32—The best way to ground any electrical system is to connect the neutral point to ground. Since the neutral point in delta systems is not readily avail-

"...and what's really different about R&IE — they'll close in against fault currents!"



HPL-C

INTERRUPTER SWITCHES

•BUILT FOR SAFE OPERATION EVEN AGAINST SHORT CIRCUITS

Ever close an interrupter into a short circuit? Ever think of what could happen?

Before it's too late—check the facts on the HPL-C Interrupter Switch, and its safety features.

SAFETY FEATURES—(1) HPL-C closes in on special heavy closing contacts, outside the interrupter—thus preventing damage to the interrupter switch when closing in on moderate fault currents; (2) High velocity "OVR-CENTR" blade closing (and opening) with the TOG-L SNAP operating mechanism—an optional feature, providing additional safety, important especially during the closing operation. For safety sake, specify these important features.

RATINGS—**Fused HPL-C Interrupter Switches**
up to 14.4 KV (110 BIL)
600 Amp. (40,000 Mom.)
1200 Amp. (60,000 Mom.)

RIGHT—*TOG-L SNAP operating mechanism, featuring "OVR-CENTR" spring actuator—optional, but important to safety in closing.*

TESTS—Switches have actually closed against moderate 3-phase fault currents at 4.8 and 13.8 Kv—proving that the HPL-C offers a high degree of protection. Ask the I-T-E Representative to give you the performance facts. They will show you how to save on installation costs with standardized engineering; on operating costs by preventing costly shutdowns; on maintenance costs through simple inspection and up-keep requirements and the accessibility to equipment.

R&IE

R&IE EQUIPMENT DIVISION
I-T-E CIRCUIT BREAKER CO.
GREENSBURG, PA.

HPL - 2

able, it is necessary to establish a neutral. This can be accomplished in either of two ways. The first is to connect the bus to a zig-zag grounding transformer and solidly ground the neutral. The second is to use three single-phase distribution transformers rated at 480 volts primary and 120/240 volts on secondary. The primaries should be connected in wye and solidly grounded at the neutral, the secondaries should be connected to form a delta.

The basic reason for grounding the system is to reduce the magnitude of transient overvoltages, but also it is desirable to allow sufficient line to ground fault current to flow to enable the overcurrent devices to operate properly for line to ground faults. The amount of grounding transformer reactance required to satisfy both conditions is given by:

$$X_{GT} = \frac{KV^2 \times 3{,}000}{KVA} \text{ ohms/phase}$$

where KV is the line to line voltage
KVA is the system initial 3-phase short circuit KVA

This formula will provide enough reactance to limit the overvoltages and will provide a fault current on line to ground faults equal to approximately 60% of the 3-phase fault current. The grounding transformer must be able to carry the maximum line to ground fault current for the short time during which it flows. This time is usually not more than ten seconds.

By grounding your system in this fashion nearly all of the advantages obtainable with a solidly grounded wye connected system can be obtained.—D.S.B.

ANSWER TO J32—There are three choices for grounding the existing system without changing the transformers. The first and simplest method is to ground one phase of the delta. This method has certain limitations and disadvantages, however, including the necessity for positive phase identification throughout the system, and elimination of overload relays, meters and instruments from the grounded line. Isolation motor control circuits through the use of control transformers would assure safer operation.

The second choice would be to connect the ground to the midphase of the delta where the tap is available. Some of the disadvantages of the first method can be avoided through the proper selection of motor branch circuit overcurrent devices.

Building blocks that spell . . .

. . . a NEW kind of modern

fire protection

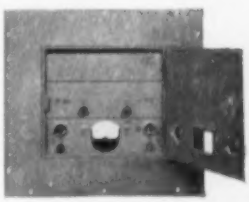
Modularm is a completely new fire alarm system of building block design. The building blocks are compact, modular units called Alarm Initiating Panels, Alarm Signal Panels, and Power Panels—all standardized and designed for economy. Combined, they produce any of these wide variety of UL-approved systems:

Manual, automatic, and/or pre-signal non-coded systems.

Manual or automatic common-code or zonal code systems.

Manual or automatic selective-code, selective-code continuous-alarm after code, or selective-code pre-signal systems.

Modularm has these additional features—



Provisions for automatic alarm connection to municipal fire stations.

Dead-front design of control panel isolates high voltage, permitting installation anywhere.

Single or double supervised power supply.

Auxiliary test switches — pilot lamps.

Automatic fire detection for non-supervised areas.

Integrated design, easy installation and superior performance make *Modularm* the most modern and complete fire alarm system available today. Write for Couch's Modularm Brochure #131.

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DOES SO MANY
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Interlocking channels . . . a Channellock exclusive
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No. 420

Help yourself to a Channellock No. 420 . . . the handiest plier of them all. It grips like a pipe wrench . . . is easy to use in hard-to-get-at places. And Channellock has gripping features found in no other plier: Interlocking channels that can't slip or "jump out" and the reinforced tension edge that withstands maximum gripping force. These exclusive features are the reasons why Channellock is the first choice of mechanics everywhere. So ask for Channellock . . . and be sure you get *genuine* Channellock. Look for the trade mark on the handle.

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CHAMPION DIARMENT TOOL COMPANY
MEADVILLE, PENNSYLVANIA

The third and most satisfactory choice would be to connect a zig-zag grounding transformer through a protective device to the main plant bus.

A careful study of the plant will have to be made to determine which method can be economically justified. In the meantime, a ground detection system could be installed to avoid the potential hazards of a ground on the existing system.—R.G.O.

ANSWER TO J32—Two methods can be used in solving the difficulties implied by this question:

1. Install a system ground on one phase of the system in accordance with Art. 250 NEC. Sec. 2514 permits this to be done for 440-volt systems. The result will be to definitely place line voltage to ground on the two ungrounded phases. Grounds on these phases will then result in fuses blowing or other failures which are evident as grounds occur. This method can be applied where transformers are property of the plant, otherwise, the utility supplying current should be consulted. Where two conductor motor protection is in use, the ungrounded phases should be protected.

2. Use a reliable ground detector on the system and clear all grounds as soon as they occur. We have used this method (with other measures), and motor failures in the municipal sewage treatment and water pumping plants have been almost completely ended. This method requires the detector to be under observation by the plant operator trained to note and report grounds. One ground is usually not immediately serious. When two phases become grounded, the effects are difficult to deal with due to distance apart, intermittent effects, problems of isolating both failures, etc. The detectors we use will be described in detail on request. Only one is needed for each secondary system and is readily located anywhere in the system.—J.W.E.

Motor Protection

QUESTION K32—Some machine manufacturers install a 5 hp motor, a 20 hp motor, and a 25 hp motor with magnetic switches and insist that fuses are not required to protect the individual motors. Are they correct, or shall I insist that the motors must be better protected?—H.S.

ANSWER TO K32—Such arrange-

AND **SAVE!**

. . . ON UNION'S CONVENIENT # 3 BRACKET BOX OR BAR HANGER COMBINATION.

UNION'S
NEW 3090
.....A 3½" BOX WITH 4" WIRING CAPACITY
ELIMINATES
PLASTER RING

Write for literature and free samples.

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Xduct Junior EMT to the

ONE SURE FISH TEST... TRY IT YOURSELF

A special enamel inside coating gives National Electric Xduct Junior EMT its superior fishing qualities.

This specially developed inner wall finish not only protects the interior of the conduit against corrosion but provides a smooth slick surface that reduces friction between conduit walls and wires to a minimum. Actual fish tests on 6 leading types of conduit conducted by "on the job" electricians proved Xduct Junior more than twice as easy to start and far easier on the constant pull.

Try fishing Xduct Junior yourself.

In addition—NE Xduct Junior is easy bending. It's made of a high quality, very ductile metallic tubing. When properly bent, Xduct Junior will not flatten at the bend.

NE Xduct Junior has full zinc protection. Every length is silver-bright, with an electrogalvanized protective zinc coating that will not flake or crack.

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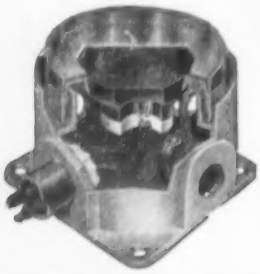
Dependable, trouble-free service has always been the chief appeal of "Latrobe" Floor Boxes and Wiring Specialties.

Easy and quick to install, Latrobe products serve long and well.

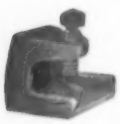


ADJUSTABLE FLOOR BOXES

Adjustable Floor Boxes are bonded which makes them fire-proof—come in single round or square bodies—also furnished in square single gang, two gang, three gang and four gang types.

Non-Adjustable Floor Box

Represents the last word in unique design, neat appearance, fewest number of parts, and least amount of labor to install.



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Malleable iron clamps of high tensile strength. Four sizes to fit all standard porcelain or glass insulators.

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ments are permissible under certain conditions as provided by section 4343 of the National Electrical Code. These provisions can be briefly summarized for the motor sizes mentioned as follows:

1. Each motor-running overcurrent device and each motor controller must be approved for group installations.

2. The fuses for the group must be large enough to start the largest motor of the group when all the other motors in the group are running, and yet these fuses, at the same time, must be not greater than 400% of the running current of any such motor thus protected.

3. The individual motor conductors must be as large as the conductors feeding the group or be ⅓ as large and not over 25 ft long and protected from mechanical injury.

If all of these conditions are not met, then individual fuses must be provided.—W.R.S.

ANSWER TO K32—It is not possible to provide adequate protection for a 5-hp, a 20-hp and a 25-hp induction motor fed from a common feeder by utilizing individual ac magnetic starters. The starters should include suitable thermal overload devices to protect against sustained heavy overloading of the motor and subsequent burnout.

With this type of control system the machine manufacturer has left the short circuit protection of the motor to the user, expecting him to provide a suitably protected feeder circuit for the machine in accordance with section 4343 of the National Electrical Code. However, in order to fuse the bleeder circuit in accordance with this section, a fuse size must be selected that exceeds the maximum size permitted for the 5-hp motor by section 4330 of the NEC. This would require the use of a separate set of fuses for the 5-hp motor starter. Actually, for complete protection, fusible combination starters with current limiting fuses should be used for all motors.—L.D.B.

ANSWER TO K32—We would much prefer the magnetic switches, with properly selected coils and heaters for each motor, to a system of fuses. This is particularly true of a 3-phase application. Their use will guard against motor failure from single phasing, which is a prevalent cause of motor burnout. We would further specify the use of the new magnetic switches utilizing a protective device on all three legs as opposed to the method of protecting two legs only.

This minimizes chances of failure due to grounds on an unprotected leg. A properly fused main disconnect switch controlling the three magnetic switches is recommended as it would greatly aid your maintenance man. Further, the installation must comply with NEC 6742.—F.W.G.

Transformer Loading

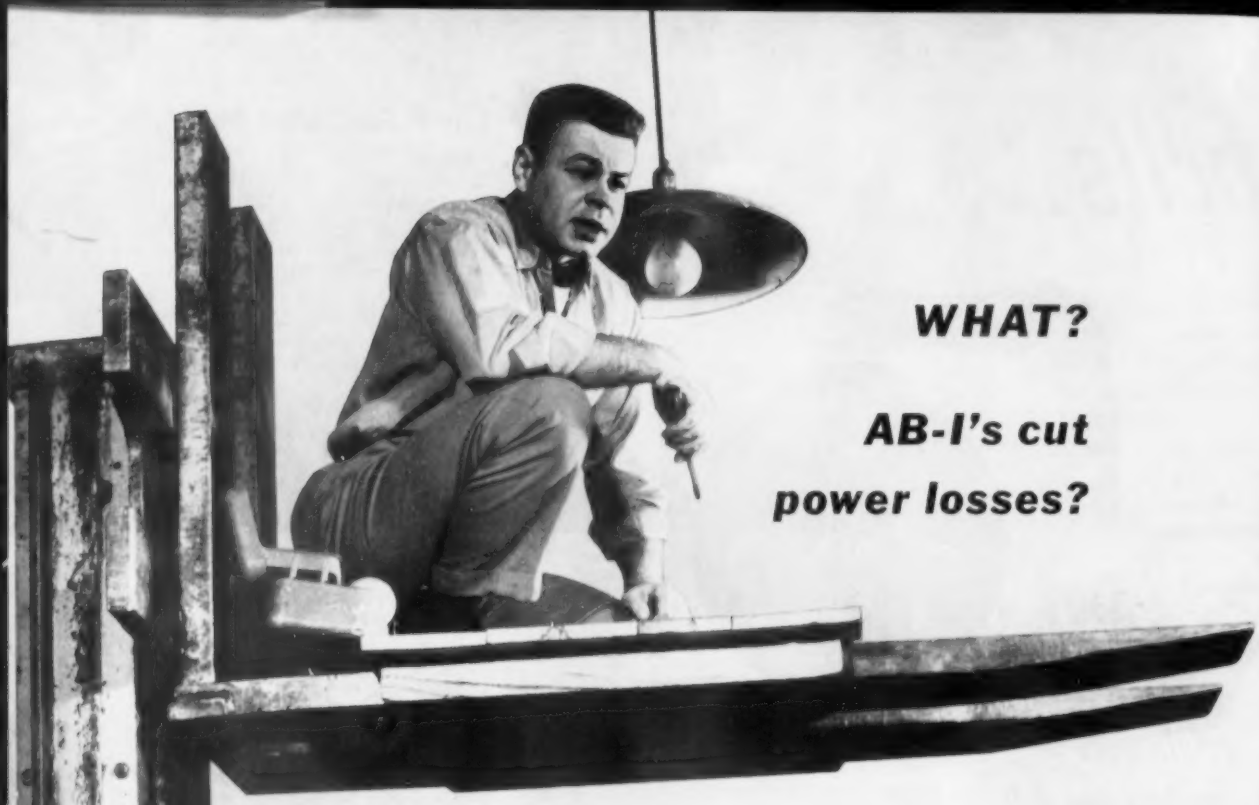
QUESTION L32—How would you determine the maximum output of a transformer, 2300 to 115-230 volts? We have a 10 kva feeding a 100-amp service switch with a 90-amp load not constant. We have not lost a transformer in 25 years. —F.R.L.

ANSWER TO L32—The amperage rating can be obtained by dividing the volt-amperes ratings (kva x 100) by the voltage. In the present instance, 10,000/230 gives 43.5-amp at 230 volts. If the secondary coils are connected in parallel, instead of in series, the rating would be 87-amp at 115 volts. The latter situation is not common in present day practice.

The manufacturer's rating is based upon continuous loads. It may safely be exceeded if the load duration is sufficiently short and the no-load or low-load period is sufficiently long that the transformer temperature does not reach a point high enough to damage the insulation. The only real guide to heating conditions is through the use of suitable temperature indicating devices. Even then, there is an element of gamble.

Since the transformer has been operated at 207% rating (90/43.5), it is evident that the load-rest periods have been sufficiently balanced to date. It is open to conjecture, however, how much the useful life of the transformer may have been shortened.—L.E.B.

ANSWER TO L32—The 10 kva transformer is good for not more than 50 amps continuous duty. If the cooling is restricted, then the amps go down. If the cooling is improved, then the amps go up. If the load consists of a 70-amp steady load, then the transformer will not last five years, but if the transformer will carry 95 amps for five minutes and yet have an average 35-amp load during each 20-minute period, then you will need a 125-amp fuse to carry the load and the transformer will last more than 25 years.—H.S.



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AB-I's cut power losses?

CONSIDERABLY. Current flows so freely through the low impedance in circuit breakers that power loss is usually no more than that in the line. Electrically welded connections, low-current-density loading of parts and silver-alloy contacts keep watt loss to a minimum. Compared to other protective devices, this adds up to substantial dollar savings.

AB-I's also pay off by saving the cost of unnecessary down time. It takes but a flip of the handle to restore power after a circuit has been cut out due to a fault or overload. There's no lost time checking, finding and installing replacement parts.

There are at least four ways you save hard cash when you use AB-I's . . .

1. In cost of original equipment
2. In cost of replacement
3. In less power consumed
4. In less production time wasted.

AND, you provide the most positive protection for your equipment.

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The finest bells are engineered and manufactured by WHEELOCK. Indoor and outdoor types are available in sizes from the new 2½" midget a-c contactless vibrating bell to the large 20" model—[2½", 3", 4", 6", 8", 10", 20"]. Write for Catalog 5A-3

originators of the underdome bell

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24" - 120" SIZES!

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- Opens the door to many big jobs formerly possible only with costly fans!
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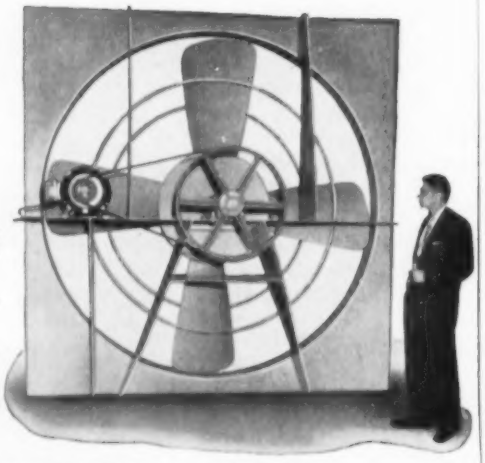
- Package design—easy installation as ready-to-run units!
- A new high in propeller fan performance and durability!



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INDUSTRIAL EXHAUSTERS BELTED VENT SETS PROPELLER FANS "E" BLOWERS-EXHAUSTERS

Lawn Sprinkler Control

COMMENT TO A32 (June, page 167)—B.A.S. asked for advice concerning a means of distributing water through a number of supply pipes in sequence and for definite times for automatic lawn sprinkling.

There is a control system available which is designed for just this service. The Tork Automatic Sprinkler Control, made by Tork Time Controls Inc., will handle from two to ten sections of supply pipe each operated by individual solenoid valves. The starting time is set on the 24-hour dial, the duration time on the minute dial. The control will start the sprinkling operation at the same time each day and sprinkle, section by section, for the required period.

A rain control prevents sprinkling if rain has fallen sufficiently to the needs of the grounds. A selector will eliminate sprinkling on selected days. In addition, the control provides varied timing of individual sections, allows for automatic pumping, manual control or other special needs.—D.J.W.

Can You ANSWER These QUESTIONS

QUESTION V32—In the plant in which I work, we have a lot of makes of coils with numbers and without numbers but no voltage rating. Most of these coils are for solenoid valves in hydraulic systems.

I would like to know if there is any way in which to check these coils for the proper voltage.—A.P.

QUESTION W32—Our local YMCA built about 1914 has an Annunciphone No. 3283 1914 from the Sampson Electric Co., Canton, Mass. As this firm is out of existence, it is impossible to get a diagram or parts from them so I would appreciate any information your reader's might offer to service this phone system.—R.S.B.

QUESTION X32—Where would it be advantageous to use generators, which have a very high reactance, besides in hazardous locations and where many people congregate or as welding generators? What percentage of the total generator kilowatts on land are in hazardous locations or where many people congregate?—E.B.

PLEASE SEND IN YOUR ANSWERS BY SEPTEMBER 15

Because of SPANG's high quality, Cahn Electric unconditionally guarantees the SPANG HD Conduit installation at the Childs Food Stores Building for one year, reports Mr. R. C. Jackson.

"SPANG® Conduit has the quality to do the top-flight job required of it"

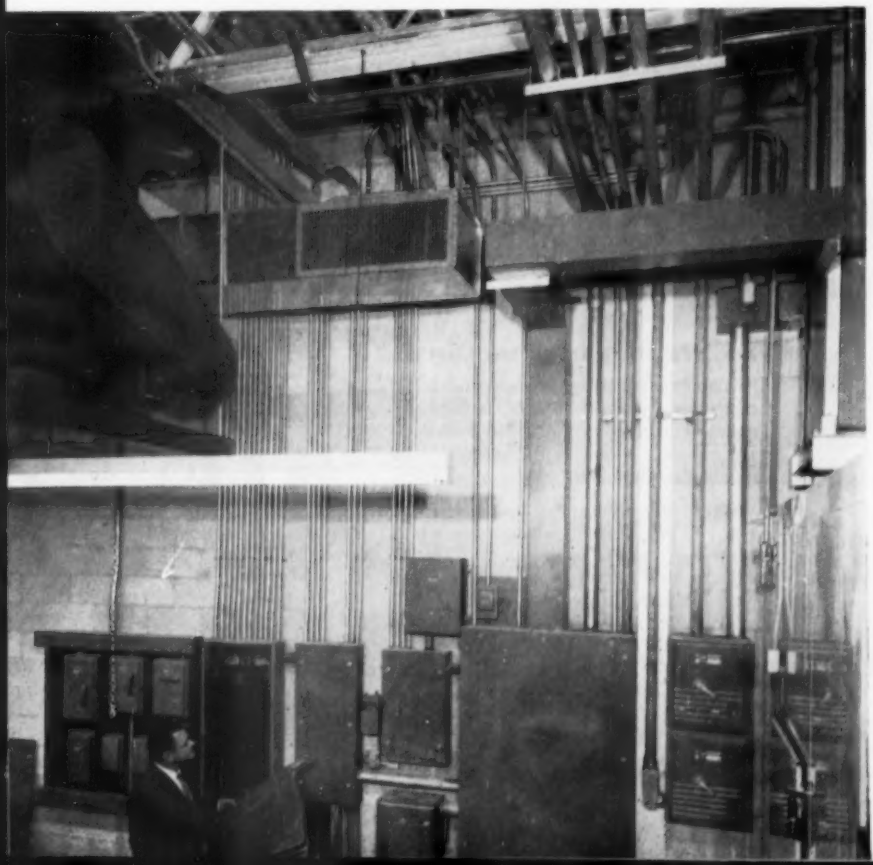
—says Mr. R. C. Jackson, Cahn Electric Company, Shreveport, Louisiana

72,000 ft of SPANG HD go into Childs Food Stores Building

The new Childs Food Stores Building in Shreveport, Louisiana, houses the division offices, garage, warehouse and a supermarket, and contains a total floor space of 263,000 sq ft. Electrical equipment, in addition to the regular and emergency lighting systems, includes air conditioning, refrigeration facilities, public address system, intercom system, burglar and fire alarms and a conveyor.

"The wiring throughout the building is protected by 72,000 ft of ¾" to 3½" SPANG HD Conduit," says Mr. Jackson. "We used SPANG for two reasons: first, because of our company policy which calls for maximum quality of all materials used; and second, because we know we can count on SPANG meeting its delivery schedules.

"The installation of SPANG HD was easy and presented no problems. We're so confident of its performance that we guarantee its installation unconditionally for a one-year period. We expect it to last a lifetime."



SPANG Conduit protects the wiring systems throughout the entire $2,250,000 building. Final check of wiring and conduit is made by Mr. Jackson.

Let SPANG guard your reputation

You can make *top-quality* installations, too, with SPANG Conduit. As a result of *quality-control* during manufacturing, SPANG is uniform, easy to install, highly resistant to corrosion. You can't buy a better conduit, so try it on your next job. Call your local SPANG Distributor for *top-quality service.*

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General Contractor:
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Electrical Contractor:
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SPANG Distributor:
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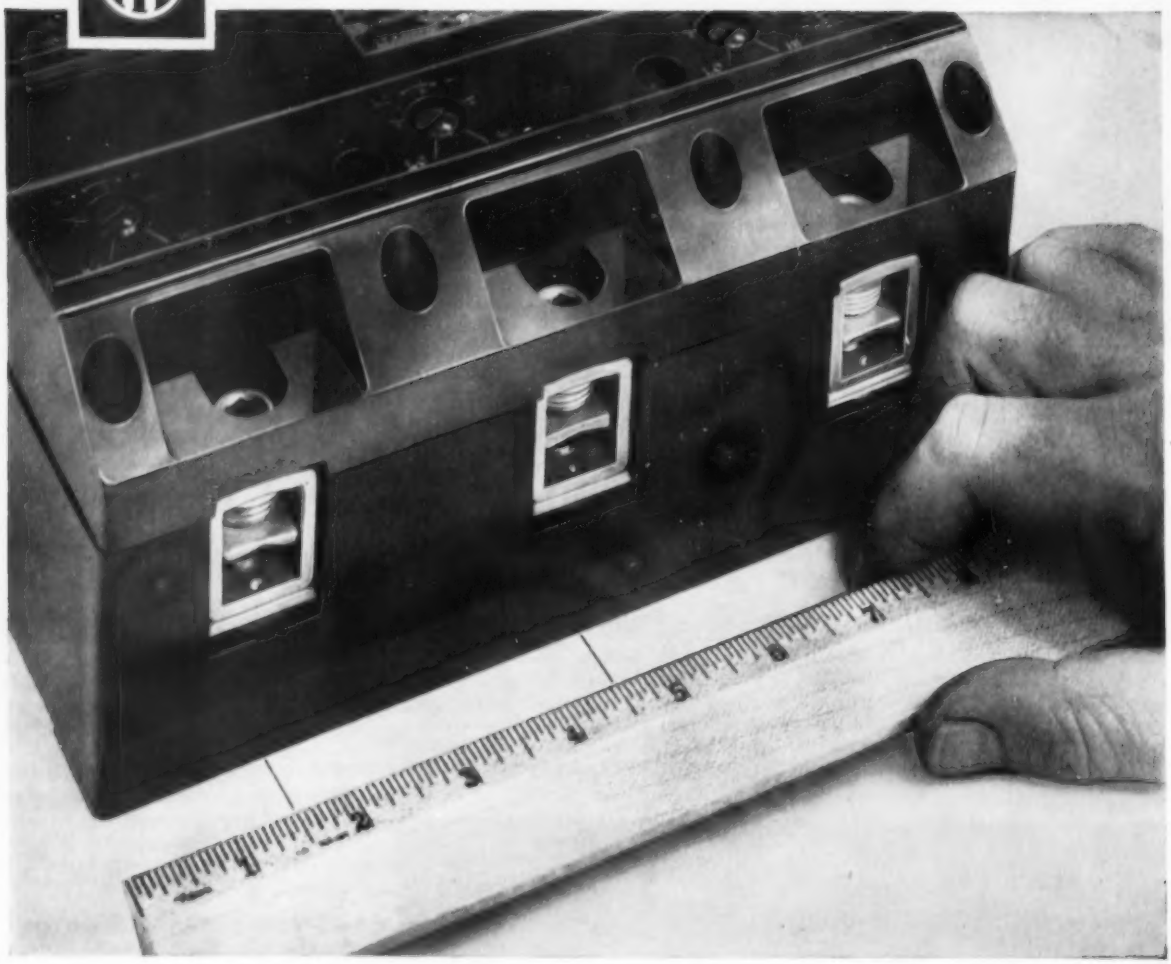
MOLDED CASE CIRCUIT BREAKERS



I-T-E Molded Case Circuit Breakers Have Extra-Wide Pole Spacing

In most circuit breaker applications, the extra-wide pole spacing in I-T-E circuit breakers could be important to you for at least three reasons:

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2. Facilitates installation
3. Breaker design permits sturdier construction

Minimum spacing between I-T-E pole centers is $1\frac{1}{2}$ in.—3 in. in all larger breakers. Thus I-T-E molded case circuit breakers give you the maximum in design as well as in performance.

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Wider pole spacing and enclosed terminals are but two built-in advantages which contribute added value to you—at no extra cost. Contact your nearest I-T-E representative for details.

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Questions on the Code

Answered by:
B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
GLENN ROWELL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*

Motor Disconnecting Means

Q. *Below is a diagram of a cooling system in which the motors are on one side of the building and the service switch is by the meter which is 101 ft on the other side of the building.*

They have two motors both of which start at the same time. I have turned this job down for there is no switch at the motors since the meter switch is out of sight. The arrows show how you will travel to cut off the switch. The switch at the meter can be locked. It also has a 9 hp on three No. 8 wires and the total length is about 50 ft.

We had a Board meeting and the four members agree that I am right, but the contractor says we are all wrong. If you will put this in the proper hands and make the right interpretation, I will appreciate it very much.—W.G.

Q. *Pertaining to same application.*

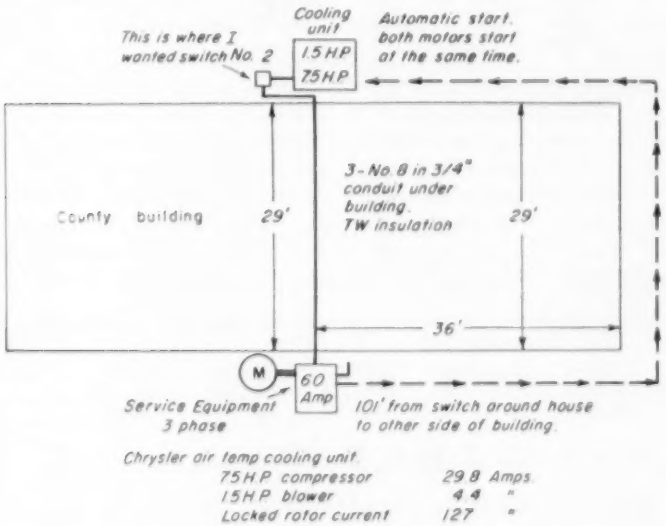
Would you please answer this question for me as our electrical inspector has agreed to take your decision. In the diagram, I have hooked up an air conditioning unit with two integral motors from a 60-amp switch which is out of sight from the motor. This switch can be locked in the open position. Does Article 4409, 4410 and 4386 allow this to be done this way or does another disconnect switch have to be installed in sight of the motor? Does article 4408 prohibit this installation?—R.L.G.

A. According to the provisions of Section 4408 of the Code a service switch may serve as a motor disconnecting means only when the load connected to the service consists of a single motor. A literal reading of this rule indicates that the inspector is correct in his contention that there is a code violation, not on the basis of the location of the switch, but solely on the provisions of Section 4408. In the case presented however we have a cooling unit assembly consisting of a compressor motor and a small blower motor, approved as a unit by Underwriters' Laboratories, and I am inclined to believe that the original intent of Section 4408 never considered such a unit assembly, and possibly never intended that such a unit could not be served by a service switch when all of the other provisions of Section 4408 are satisfied.

One of the important provisions for a motor disconnect is covered by Section 4402, which requires the switch to be rated in hp. If the 60-amp service switch is rated in hp I believe it would be limited to 7.5 hp. Another important provision of the code is covered by Section 4403-b. This rule concerns the disconnecting means for a sealed (hermetic type) compressor motor and undoubtedly applies to the 7.5 hp motor under discussion. According to this rule, the disconnect switch must be rated at 15 hp which usually corresponds to a 100-amp switch. Another Code rule to be satisfied concerns the 60-amp fuseholder integral with the 60-amp switch. Section 4346 covers the size of the fuseholder used for a motor branch circuit and according to Table 20, a motor with a full load current of 29.8 amps, full voltage starting, would require a 100-amp fuse. Section 4410 also is involved since the combined load of both motors is 9 hp.

Another factor to be considered is the fact that both motors start at the same time. I believe, if you check these code provisions, you will find that the disconnecting switch for the cooling unit in question must be rated at 15 hp and 100 amps and possibly time lag fuses must be used.

Insofar as the code is concerned the disconnecting means could be located more than 50 ft from the motor provided it is arranged to be locked in the open position. See Section 4409. Such procedure however has been questioned by some inspectors on the basis that the provisions of Section 4411 requires the disconnecting means to be readily accessible. (See definition of readily accessible.) In the case presented I believe the 60-amp service switch, even though it is located 101 ft from the motor is readily accessible within the intent of the rule. It should be remembered that the principal hazard to be safeguarded concerns the electrician who maintains the motor and its controller. When the disconnect switch is located adjacent to the motor which he is repairing, he has reasonable assurance that the switch will not be closed. He has the same assurance when the switch, even though out of sight


This is where I wanted switch No. 2
Cooling unit
1.5 HP
7.5 HP
Automatic start. both motors start at the same time.
3-No. 8 in 3/4" conduit under building. TW insulation
County building
29'
29'
36'
M
60 Amp
Service Equipment 3 phase
101' from switch around house to other side of building.
Chrysler air temp cooling unit.
7.5 H.P. compressor 29.8 Amps
1.5 H.P. blower 4.4 "
Locked rotor current 127 "

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Sycamore, Illinois

and several hundred feet away, is locked in the open position and he has the key in his pocket. Another hazard, which the code does not specifically cover, concerns the occasion when a controller fails to function or an accident on the driven machinery involves personnel, and it becomes important that the motor be disconnected promptly. Under such conditions, a disconnect located 100 or more feet from the motor could not be reached promptly for operation. Such conditions are not specifically covered by the Code. Many years ago they were, but they have not been recognized for several years.

Another factor involved with the present installation concerns the No. 8 circuit conductors. According to Section 4314 of the Code the size of the conductors are computed as follows:

7.5 hp—125% of 29.8 amps equals ..... 37.3 amps
Full load current 1½ hp 4.4 amps

Total ..... 41.7 amps

I am assuming that the small motor is 3-phase. This value slightly exceeds the current-carrying capacity of No. 8 TW conductors and is considered a code violation.

A brief summary of the foregoing, strictly on the basis of code provisions, indicates that both the service switch and the conductors are not large enough. A liberal interpretation of Section 4408 of the code could be used to recognize the use of the service switch as the disconnect, provided there is sufficient assurance that no additional loads will be connected in the future to the service. Insofar as the code is concerned, it appears that the location of the disconnect with respect to the motor, in terms of feet, is not considered to be important provided the disconnect is arranged to be locked in the open position. Some of our wiring design engineers however would not hesitate to specify a second switch at the equipment.—B.A.McD.

Overload Devices

Q. *In a new motel here the owner is planning on using individual air conditioning units in each apartment which will either cool or heat the space. The full load running current of the motor in each unit is approximately nine amperes and the resistance heater is rated at 14 amps. May we fuse*

Mr. Safety-Grid
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CONTRACTORS Prefer
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All-Electric HEATERS

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Spread a shield of comfortable warmth against cold walls, without drafts. Controlled by thermostat in each room. Matching baseboard fittings permit carrying out pleasing unbroken baseboard effect in any room.

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For bathroom or small room

Complete Line of ELECTROMODE HEATERS
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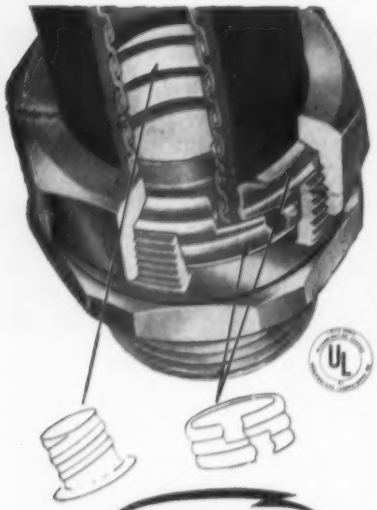

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The only completely REUSABLE connector!

PROVIDES PERMANENT WIRING PROTECTION

● Easy-to-apply... Ideal-Simplet Vap-Oil-Tite Connectors adjust quickly to conduit size variations. They positively seal out vapor, oil, water or dust. Grounding bushing assures positive ground . . . flange covers raw ends of conduit . . . and you can actually see that the bushing seats all the way!

Exposed parts all *non-corrosive* metal, Vap-Oil-Tite Connectors have positive ground, tapered threads, and tremendous gripping power through serrations on split ring. Underwriters' Laboratories, Inc. approved with 200 lb. pull test. Fit both EF and UA conduit. Write for further details and prices.

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these special circuits with 15-amp fuses?—T.R.B.

A. No, the Code will require that the overload current protective devices used to protect the circuits be rated at least 20 amps as you will note under paragraph b. of Section 2125, which states:

"The total load shall not exceed the branch circuit rating, and shall not exceed 80% of the rating where in normal operation the load will continue for long periods such as store lighting and similar loads."

As it is quite common in motels to find the point of distribution at quite some distance from the furthermost units, we trust you will give careful consideration to voltagte drop in the selection of the conductors to be used for these circuits.—G.R.

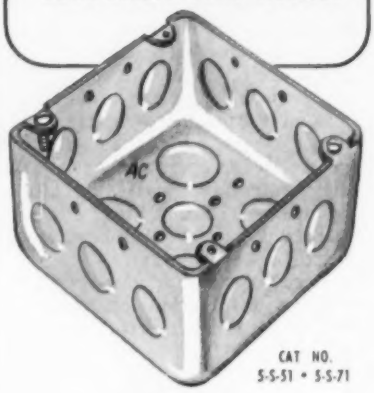
"Okotherm" Aluminum Sheathed Cables

Q. *Okonite Company's "Okotherm" seems like a most excellent product as described in Okonite's Bulletin No. 1088 A. It does not appear to be covered by either Article 334 or MI in Article 330 as the latter is described as having "highly compressed refractory mineral insulation". "Okotherm" aluminum sheathed cable has a "liquid tight & gas tight metallic tube sheathing" but has a silicone-glass fiber insulation in place of the "refractory mineral". Okotherm is made in No. 19 to No. 6AWG.—R.W.K.*

A. According to the 1956 listings of Underwriters' Laboratories, including the June and August supplements the only Mineral Insulated Metal Sheathed Cable approved by U. L. is manufactured by the General Cable Corp. According to Okonite, "Okotherm Insulation" is a thermo setting material compounded from silicon rubber. The 1956 Code recognizes silicon insulation for fixture wires but it has not as yet been recognized as a suitable insulation for the various general wiring methods recognized by the Code. I believe that the Code will eventually recognize silicon insulation for conductors larger than fixture wires, and I believe Okonite's Bulletin No. 1008 A anticipates such recognition.

Insofar as the aluminum sheath is concerned, it is significant to

Here's The Box That Is Making Electrical Contractors Take Notice!



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For general installations where maximum wiring room is required. Depth: 1½" or 2⅛". Available in any arrangement of K.O.'s up to 1¼". As many as 17 K.O.'s. Wiring capacities of 30 cu. in. and 42 cu. in. Hot-dipped galvanized finish is many times thicker than U.L. and Federal Specifications. Write for more complete details.

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When you have an installation problem not covered by our standard line, our engineers will design special units to your specifications.

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ANACONDA WIRE & CABLE COMPANY

INTER-OFFICE CORRESPONDENCE

COPIES TO:

G 4604

TO: Fred Luna

DATE July 1, 1957

FROM: W. E. Sprackling

OFFICE Hastings

SUBJECT: ADVERTISING

REFERRING TO: Quality Control
Inspection - ETL

FILE REFERENCE:

Fred, we've been telling our customers about our methods of Inspection, our Quality Control, and other manufacturing safeguards. But perhaps we're missing a bet. I think the BIG THING is what the Electrical Testing Laboratories, Inc. does for us -- not just the fact that they calibrate all of our testing equipment (that's quite common), but that they actually go through our test reports at all mills annually to see that our testing system is functioning the way management planned it.

I don't think any other outfit goes so far as to have such a complete independent audit. To me -- that's newsworthy -- our customers should know that we have an outside agency -- fully competent -- to watch after their interest.

Why not tell our story broadly -- after all, it's to the customers' interest -- they will appreciate, I'm sure, what is being done for them.

W. E. S.

P. S. And another important thing -- the inspection department is entirely separate and independent of production -- reporting only to the Vice President in Charge of Manufacturing.

JEF - What more could we say? Sin for running this as is. What do you think? Fred

OK - JEF

574122

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You save time and labor costs with SANGAMO

Easy installation and long troublefree operation is the key to worthwhile savings with the Sangamo Heavy Duty Time Switch. Costly callbacks that consume time and labor are few and far between. That's because the Sangamo Time Switch is a *quality* time switch that gives extra years of service.

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There's plenty of inside wiring space plus multiple knockouts in the back, sides and bottom of the Sangamo Time Switch. Installation is fast and easy. See these cost-saving time switches at your Electrical Wholesaler's today.

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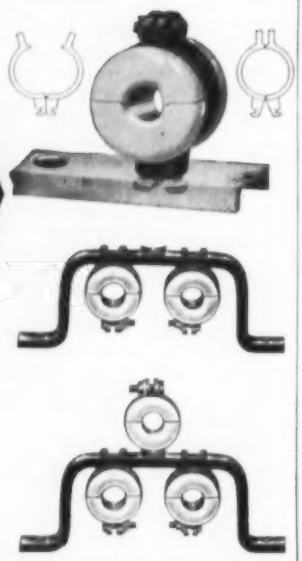
ST37-3

For QUICK, EASY, SAFE Cable Installation "EFFICIENCY" NESTED CONDUCTOR RACKS



Efficiency Nested Conductor Racks are simple, compact and are scientifically designed to carry conductors equidistant from center to center. One bolt supports the bushings, and clamps the bushing support to the frame. Available in 2-3-4-5- and 6-bushing racks.

Write for Catalog 38-A

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Efficiency ELECTRIC AND MANUFACTURING CO.

MANUFACTURERS OF EFFICIENCY ELECTRICAL DEVICES FOR CONDUIT AND WIRE CABLE SUSPENSION

EAST PALESTINE, OHIO

note that Section 93301 of the Code only recognizes a copper sheathing for Type MI cable, with specific recognition of mechanical injury and the conductivity of the outer sheath. Possibly such factors are also involved with the approval of an aluminum sheath.—B.A.McD.

Clearance Back of Switchboard

Q. *We are doubling the voltage to be handled by some of the equipment mounted on an old style switchboard in a building here which necessitates the use of some new equipment mounted on the back of this board. This new equipment being deeper than the former lower voltage switch gear reduces the working space behind the board at the points where this new equipment is mounted to about 25 in. The new portion of this board will operate at 480/277 volts while the major portion of the board will still operate at 208/115 volts. As the back of this board is still accessible from both ends, is it really necessary for us to move it out from the wall to assure 2½ ft clearance behind all portions of the board as is specified in Section 1116 of the code? We hesitate to do this due to the expense involved.—T.P.*

A. Section 3855 of the National Electrical Code would permit working spaces behind the board of less than those shown in Section 1116. You will note that Section 3855 reads as follows:

"Clearance Back of Switchboard. If the equipment or wiring on the back of the switchboard is accessible only from the space behind the board, there shall be a clear space of at least 18 in. between such equipment or wiring and the wall for a single panel switchboard not exceeding 42 in. in width, and at least 24 in. when the board consists of a wider panel or more than one panel. If the space behind the board is accessible only from one end, these spaces shall be increased by at least 6 in. The space back of the board shall be kept clear of foreign material and shall not be used for storage purposes."

You will also notice a fine print note following this section which reads as follows: "Reduction of clearances for short intervals by building columns behind the switchboard, or by equipment on a single panel in the switchboard, is permitted provided the clearances are

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not reduced below those required for a single panelboard.

"Some of the above dimensions are exceptions to Section 1112."

This Section 1112 is a misprint and should read "1116". You will also notice under Section 1116, paragraph a., the exception to the clearances required in this section where it states: "Except as elsewhere required or permitted in this Code, the horizontal dimensions of the working space in front of live parts, operating at not more than 600 volts shall not be less than". Therefore Section 3855 is the exception to these clearances and will permit the installation as you have it.—G.R.

More Than Nine Conductors in Conduit

Q. *I have a question on the Code which deals with the maximum number of conductors in a conduit.*

If I feed two 1-hp, 3-phase, 440-volt motors from a control center, each motor having a remote stop-start pushbutton at each motor, am I violating the code? Control voltage is 440 volts.

It is my understanding that the code limits nine load conductors to one conduit whether they be motor power or lighting wires, and that control wiring is not under this limitation. This seems to be expressed in Article 7265 of the NEC. The small print under Table 9, Chapter 10 of the NEC is singular "Motor and Its Controller". In Abbott's Handbook the same note is plural "Motors and Controllers."

I would appreciate an answer to this problem. Other than economics which might be involved, there is a question of good and best design. —L.A.A.

A. The provisions of Section 3012 coupled with Section 3466-c definitely limit the number of conductors in a conduit to nine, except as noted in Table 9 of Chapter 10. The fine print note following Table No. 9 reads, in part, as follows: "More than nine conductors are permitted in a single conduit for conductors between a motor and its controller". Insofar as the Code is concerned, this fine print note concerns a single motor and its controller and there has been no change as far back as the 1947 Code.

I have checked Abbott's Code Handbook and find both the 1946 and 1951 editions read as follows: "More than nine conductors are permitted in a single conduit or tubing for conductors between motors and controllers." The 1953 edition of this Handbook however has been revised to correspond with the N. E. Code requirement which covers a single motor and its controller.

On December 15, 1952, Official Interpretation No. 388 was issued as follows:

"Chapter 10, Table 9.—Allowable Fill of Conductors in Conduit.

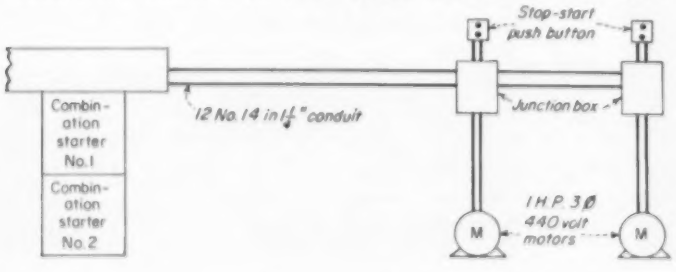
"Question: Is it the intent of the fine print note following Table 9 of the 1951 edition of the National Electrical Code to limit the installation of more than nine conductors in a single conduit to a single motor and its controller, or would more than nine conductors be permitted in a single conduit between several motors and their controllers?

"Answer: The intent is to limit the exception to a single motor and its controller."

In view of the foregoing, it is quite evident that the example shown by the diagram below violates the code. Section 7265 covers remote control, low energy power, low voltage power and signal circuits, and recognizes such circuits to be run in conduit or a raceway when more than nine conductors are involved. The 1956 revision of the code definitely recognizes such circuits in the fine print note following Table No. 9. It appears evident however that the first exception which concerns a single motor and its controller covers the case you have presented, and there is no conflict with Section 7265.

During the past two years a study of "raceway fills", sponsored by the American Iron and Steel Institute, and conducted by the Underwriters' Laboratories, under the supervision of an all-industry committee, has resulted in a fact-finding report which would recognize the procedure you have shown. This report has only recently been submitted to the National Electrical Code Committee for recognition in the N. E. Code. It is quite possible that this report will receive code recognition as an "Interim Amendment."

Insofar as design is concerned, I believe the recommendations in the introduction to the code under the heading "Wiring Planning" conveys a distinction between what is considered good design, and that which is not so considered. While economic considerations may dictate the use of a conduit containing more than nine conductors, other considerations would dictate otherwise.—B.A.McD.



Grounding

Q. *A question concerning the grounding of conduit has recently come forth during a discussion of filling station wiring where the distribution panel is located in a nonhazardous area and from that panel conduit runs extend out into a hazardous area. Will the code permit the use of ordinary locknuts and bushings on the conduit where it attaches to the distribution panel?—C.D.*

A. In paragraph c. of Section 5120 you will note the following: "Wiring and Equipment Within Hazardous Areas. All electrical equipment and wiring within the hazardous areas defined in paragraph b shall conform to applicable provisions of sections 5011 to 5025 inclusive of Article 500."

Then under Article 5026, paragraph b. you will note the following: "The locknut-bushing and double-locknut types of contacts shall not be depended upon for bonding purposes, but bonding jumpers with proper fittings or other approved means shall be used."

Therefore even though the conduit connection to the distribution cabinet is beyond the hazardous area, all conduits extending into the hazardous area from this distribution cabinet cannot be assumed to have continuity of grounding complete unless they are attached to this cabinet by means other than the locknut and bushing type of contact.—G.R.

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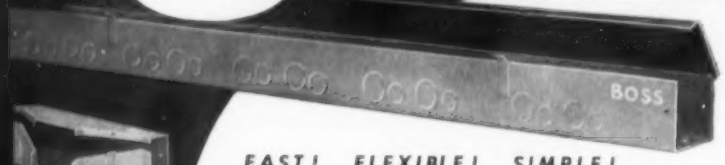

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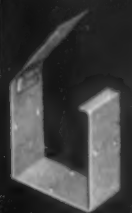

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Battery Charging Equipment

Q. *One of our warehouses is just converting from gasoline to electric fork trucks and I am now engaged to install the charging equipment to recharge the batteries on these trucks. The warehouse company is having a separate room constructed at one corner of their plant where the trucks will be located when not in use and I planned to light this room with four overhead incandescent fixtures until the question came up as to whether or not conventional fixtures would be suitable on the ceiling in view of the hydrogen which will be given off by the batteries while they are being charged. Will the Code require that the ceiling or any portion of this room be considered as a hazardous location. —A.C.S.*

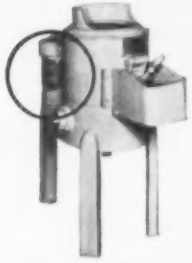
A. Under Section 4807 of the National Electrical Code, you will find the provisions covering battery rooms and I believe it advisable to comply with the provisions contained under this section in planning a room in which a number of electrically operated fork trucks will be housed and charged. You will notice under paragraph g. the requirement that sufficient ventilation be provided to assure the prevention of an accumulation of explosive mixture in such a room. Due to the difference in weight between air and hydrogen, this does not present a very serious problem as your hydrogen will gather immediately at the highest point of the room from which it can easily or readily be vented to the outside. If such ventilation is provided, no portion of the room would be considered as a hazardous Class 1 Group B location.—G.R.

Appliance Circuit

Q. *In house wiring, would it be a code violation to attach the laundry outlet to the same appliance circuit which supplies outlets in the kitchen?—N.B.*

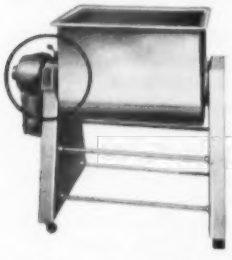
A. In most instances this would be a definite code violation as the code under Section 2123 provides that receptacles rated at 15 amps connected to 15- or 20-amp branch circuits serving two or more outlets shall not supply a total load in excess of 12 amps for portable appliances. With the many electri-

Townsend impact riveter protected by an Allen-Bradley Bulletin 600 starter.

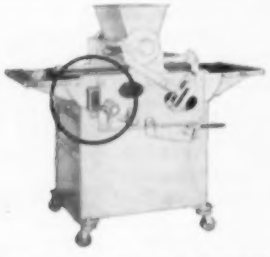


Gifford-Wood vegetable peeler with an Allen-Bradley Bulletin 600 starter.

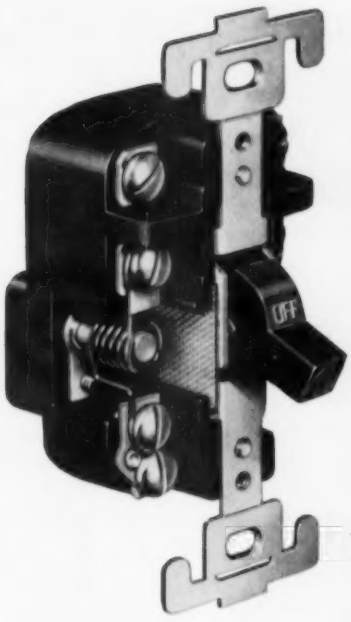
Unit space heater protected by an Allen-Bradley Bulletin 600 starter.



Kleen-Kut meat mixer has a ¾ hp motor and an A-B Bulletin 600 starter.



Triumph cookie dropper is protected by an Allen-Bradley Bulletin 600 starter.



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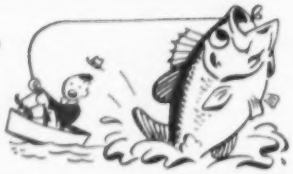

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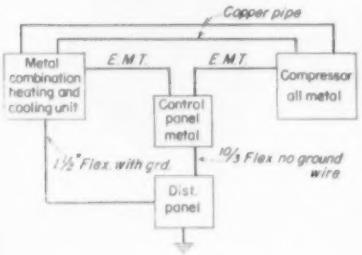
cally heated cooking devices of the portable type available to the average housewife today, it would seem only logical to believe that any appliance circuit supplying a kitchen would be unable to also supply an outlet located at the laundry especially in view of the increased loads now required by some of the automatic washing machines. This is especially true of those units having electrical immersion heaters in addition to their drive motor.—G.R.

Grounding Fixed Equipment

Q. *Article 250, paragraph 2557 —"Fixed equipment. Metal boxes, cabinets and fittings, or non-current carrying metal parts of other fixed equipment, if metallically connected to grounded cable armor or metal raceway, are considered to be grounded by such connection."*

In the sketch below, do you consider all equipment properly grounded as called for in paragraph 2557?—C.F.B.



A. As I understand the diagram, we have a 1½-in. flexible metal conduit running from the distribution panel to the heating and cooling unit. This raceway contains a grounding conductor which is not required by the code since the flexible conduit provides a path to ground. We also have a 3-conductor armored cable or flexible conduit running from the distribution panel to the control panel, which contains no grounding conductor. None would be required since the metal raceway or cable provides a path to ground. The compressor is grounded through the EMT and the raceways running to the distribution panels. Under the above conditions there appears to be no violation of the provisions of Section 2557 of the code. If the voltage to ground exceeded 250 volts the continuity of the ground circuit must satisfy the provisions of Section 2575.—B.A.McD.

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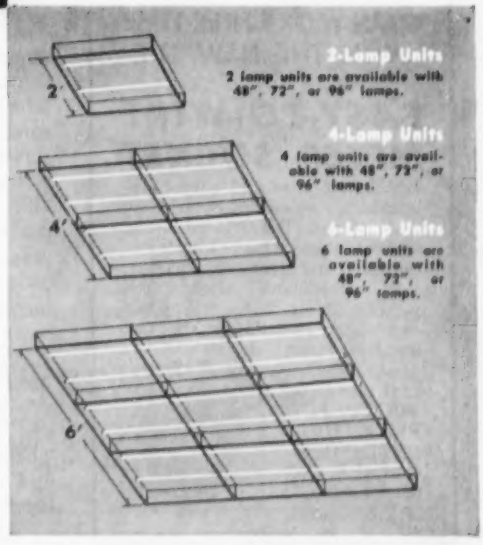
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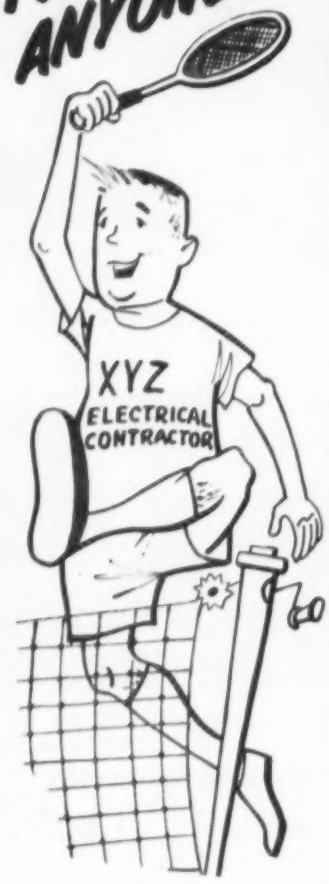

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Highway Lighting Program

John C. Boyter pinpoints the opportunities existing for electrical contractors in a discussion of the editorial "Highway Lighting—A Challange", published in the July issue of "Electrical Construction and Maintenance", page 85.*

Your editorial very clearly summarizes one of the greatest modern-day opportunities for electrical contractors in particular, and for all segments of the electrical industry.

On this subject, I wanted to bring to your attention some pertinent facts as we see them. Since the war, 53,000 miles of additional highway lanes have been built in the primary system but in the same length of time about 200,000 miles of automobiles have also been built.

We feel that lighting can help increase the capacity of existing or new highways in three ways: (1) encourage 24-hour use; (2) permit higher safe driving speeds; (3) encourage better utilization of lanes. This is particularly important in view of the 1956 total of about 65 milion autos on the road versus the 1975 expectation of about 90 million autos on the road.

The 1956 figures on night traffic tolls the death knell for 22,000 persons, plus 750,000 additional injuries, plus an economic loss estimated to be two and one half billion dollars. Whether toll of death and destruction would increase arithmetically or geometrically as the number of vehicles increases is probably a subject for much thought.

Our recommendations are for lighting "7 deadly areas" basically grouped under the broad heading of "Areas of Driver Decision". These 7 are: interchanges, bridges and viaducts, tunnels and underpasses, access roads and acceleration lanes, at-grade crossings (if any on the new Interstate system), service areas, and urbanized areas through which the highway system passes. We recommend continuous lighting for these urbanized areas, as in the case of the 53 mile Connecticut Thruway, where interchanges or other areas of "Driver Decision" are close together. Where these areas occur approximately one mile apart or less, there is not sufficient time for the eye to readjust between lighted interchanges for example, and the unlighted stretches which might separate them. At modern speeds of 60 miles per hour or more, this means less than one minute between each of such areas. Where the spurs of a highway pass through populated sections enroute to the "Central City", lighting is a must.

Our best estimates for the installed cost of lighting are: two lane system, $75,000-$100,000 per mile; six lane system, $100,000-$125,000 per miles; eight lane system, $150,000-$200,000 per mile.

The breakdown of mileage in each of these areas for the interstate system appears to be 7,000 miles of two-lane system, 33,000 miles of four-lane system, and 1,000 miles of six- and eight-lane system. In the latter 34,000-mile area are about 6,000 urban miles on the interstate system alone. With its expected cost to be $9.00 per year per motorist, our figures on the cost of lighting the expected 7% of the total mileage are about 4 to 9 cents per year per motorist. This seems like a very small amount to us if viewed by one who will be driving on the road.

We are very glad to see you treat the subject editorially for it needs the full and frank discussion of all those involved in making these highways thoroughly safe and modern. Certainly the electrical contractor has one of the greatest stakes of us all.

* *Manager, Advertising & Sales Promotion, Outdoor Lighting Department, General Electric Company, Hendersonville, N. C.*

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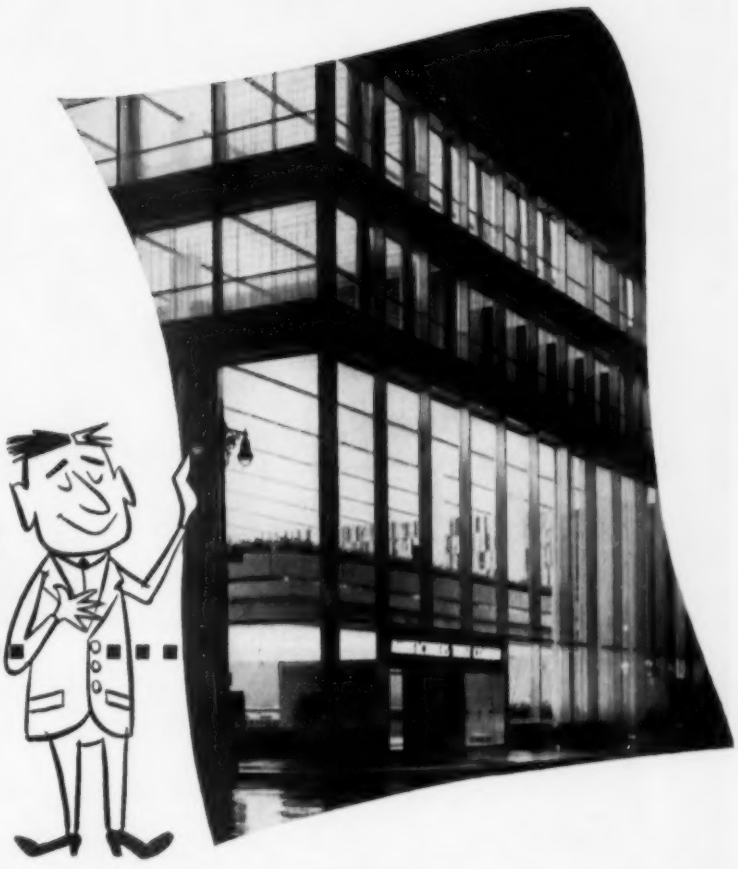

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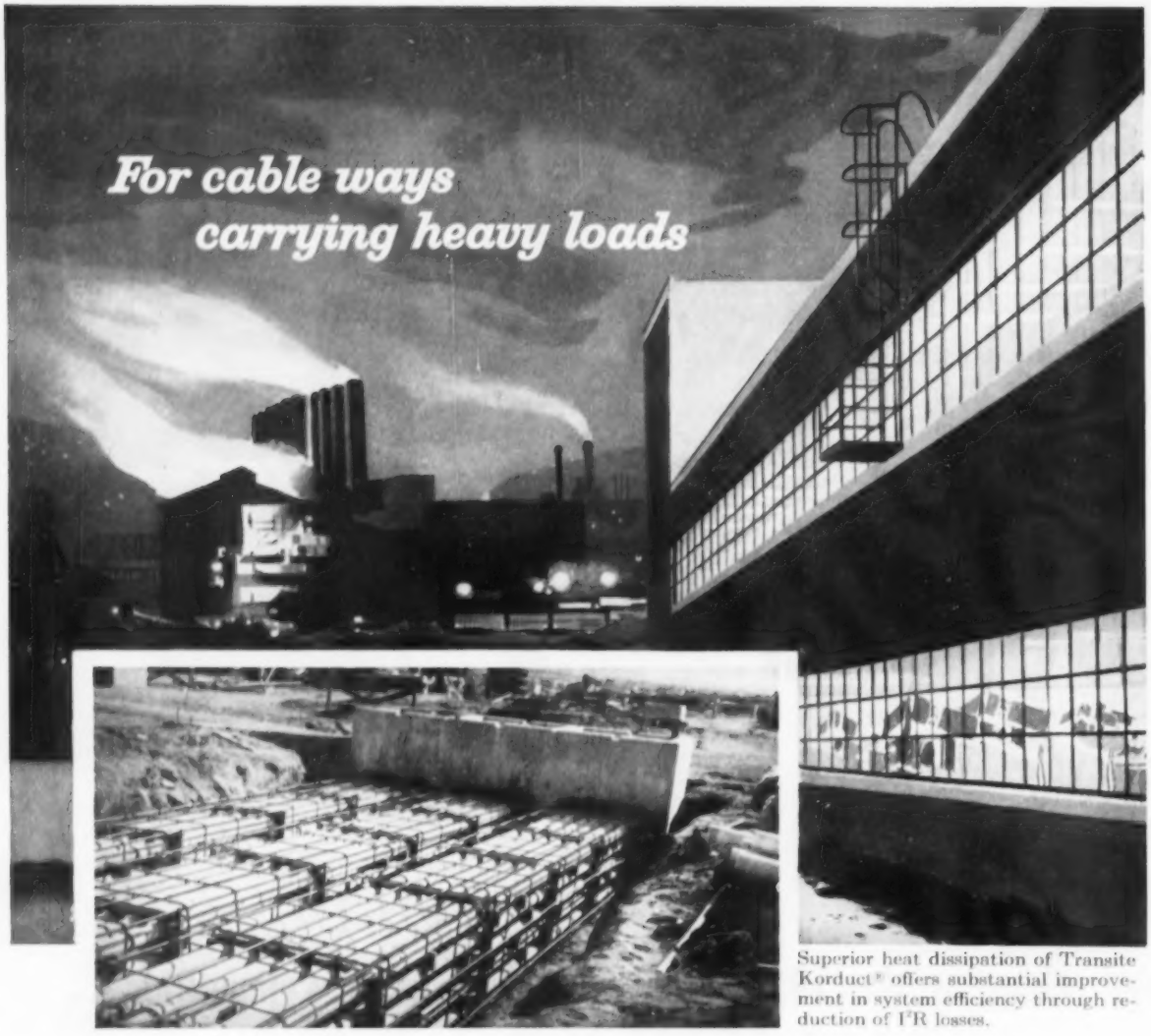

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In The News

IES Holds Northeastern Regional Conference

The Illuminating Engineering Society held its Northeastern Regional Conference in New York City this year, on June 13-14th. Ninth, and last, of the Society's 1957 series of Regional meets across the country and in Canada, the Northeastern Conference embraced a four-session program of outstanding speakers and timely subjects which resulted in a registration of nearly 200 illuminating engineers and representatives of allied professions from the New England states, New York and New Jersey.

The opening session featured three speakers, and was presided over by C. D. Hollister, chairman of the Eastern New York Section. The Conference was officially opened by Sam H. Hazleton, Conference Chairman, and Gene G. Rae, chairman of the New York City (host) Section. C. E. Waldron, IES Vice President for the Northeastern Region, introduced the first speaker, the Society's national president, Marshall N. Waterman.

President Waterman told the Conference that new demands now challenge the lighting industry. "Americans are no longer interested in merely having enough light at low cost," he said, pointing out that "they want versatility and other refinements such as were never in use before."

Using the American home as one of his examples, Mr. Waterman pointed out the fact that the reason four out of every five homes is not properly lighted is due, not to the fact that such lighting isn't available, but that the general public is largely ignorant of basic principles in lighting. He stated, however, that people are rapidly learning to "live better electrically," and that those with modern homes are dissatisfied with ancient lighting. Improvements are therefore needed, he said, for efficiency, for comfort, for health and safety, and for beauty.

Other subjects covered included atmosphere in the home, the office, even in the factory; space, and its resulting demand for lighting versatility; the need for further exchange of ideas between home decorators and designers with lighting engineers; safety—in the home, factory, and on the streets and highways, through the use of better lighting, free from glare.

OPENING SESSION of the 1957 IES Northeastern Regional Conference held June 13-14 in New York City featured an address by IES President Marshall N. Waterman (center) and a talk on "Futures Unlimited" by Dr. Samuel G. Hibben, past-president of IES, (left). The Conference was opened by Sam H. Hazelton, chairman of the Northeastern Regional Conference Committee.

Mr. Waterman concluded by stating that it is the business of the Illuminating Engineering Society to concern itself with the art as well as the science of lighting. The Society, he said, throughout its 51 years of history has not only attempted to determine the guide rules and principles of good lighting practice, but also to make available to the public its recommendations.

Dr. Samuel G. Hibben predicted that Americans will be using four times as much light only ten years hence as they are using now, in his challenging talk on "Futures Unlimited." In 1967, 20% more people in the U. S. will be using lighting three times brighter than today's illumination, he said, and they'll be using it 10% longer than we do now.

Lighting mysteries that might even have surprised Thomas A. Edison are being unraveled in laboratories today, Dr. Hibben reported, as he predicted that we shall soon see another and perhaps greater miracle than did Edison in his day.

"This will be the twin process of extracting or transforming sunlight into electricity and then converting that electricity directly into light through a magic dance of electrons known as electroluminescence," he said.

Electroluminescene, which is now being brought to efficient operating levels in lighting laboratories is a system of developing illumination by sandwiching a layer of phosphorous powder between two slabs of electrically powered glass, Dr. Hibben explained.

A. L. Hart, illuminating engineer of General Electric Co., Nela Park, gave a paper on "Outdoor Lighting —Sign Techniques and Floodlighting." In this presentation, illustrated with slides, fundamental principles of good design and application were discussed at length.

An Application Session was presided over by C. M. Holden, chairman of the New England Section of IES. John Neidhart, of the Miller Company, Meriden, Conn., discussed the "Influence of New Coefficients of Utilization" as developed in connection with the Society's new zonal flux method of computing illumination values.

R. D. Bradley, of DayBrite Lighting Inc., St. Louis, discussed at length "Comfort Ratings As Influenced By New IES Codes."

Francis Clark, Lighting Services Inc., Waterbury, Conn., discussed the highly important, and sometimes neglected, subject of "Servicing of Lighting Installations."

A session of unusual interest to all members, and a highlight of the two-day Conference, was devoted to, "Lighting, Color and Decoration." A panel composed of three nationally-known authorities on color and its uses discussed new ways in which color can be introduced practically and artistically into lighting and structural design.

Harold Rambusch, Rambusch Decorating Co., New York, designer of lighting for churches and public buildings, dicussed "The Coordination of Lighting and Architecture," covering the practical application of lighting with due regard to color and decoration. Light is pre-eminent among the many tools of the artist or architect, Mr. Rambusch said, as he compared the various types of light to the instruments in an orchestra.

He defined architecture as a sub-

division of art, and then related lighting to art as a thought, an idea, born in the mind of the gifted individual. The application of light is either flattering, innocuous or harmful, he said. It can make or break an interior. The aesthetics of applying light to architecture may be called the art of illumination, he explained, and the methods may be called the science thereof.

Rollo G. Williams, Manager of the Color Lighting Department, Century Lighting Inc., New York, and a research scientist in the color field, talked on "Lighting and Color" from the physics and psychological standpoints. He also described some of the newer methods of producing light in color of any hue or brightness, and gave reasons for using different colors to achieve different psychological and artistic effects.

Maria Bergson, of Maria Bergson Associates, Los Angeles and New York, color consultant to industrial firms, discussed "Color Application In Lighting." Comfortable lighting is one of the key elements in designing an efficient office or plant, she said, in which employees can be happy at their work and in which employers can be assured of a minimum of absenteeism and staff turnover.

Modern lighting also contributes importantly to the pleasantness of a working area, beyond supplying illumination of a specific type and intensity to meet the diversified needs of employees' seeing tasks, Miss Bergson declared. It is an almost indispensable aid, she said, in establishing through color patterns those moods most conducive to efficient production.

COLOR was a featured theme at the recent 1957 IES Northeastern Regional Conference for a half-day session, and featured a panel of three outstanding authorities in this field. They were (l to r): Rollo G. Williams, research scientist on color lighting, Century Lighting, Inc, New York City; Miss Maria Bergson, color consultant to industrial firms, Maria Bergson Associates, Los Angeles and New York City; and Harold Rambusch, designer of lighting for churches and public buildings, Rambusch Decorating Co., New York City.

LOUIS K. COMSTOCK joins John W. Frommer, president of the L. K. Comstock organization, at their company's booth during the recent 50th annual meeting of the National Association of Building Owners and Managers which was held this year in New York City's Waldorf Astoria Hotel. This booth, emphasizing the importance of good electrical planning and construction, demonstrated how modernization can be accomplished with little inconvenience and important advantages to tennants and building owners alike. Background for the exhibit was a silhouette skyline of New York City composed of a composite grouping of buildings in which Comstock & Co. has completed major electrical modernization and new installational work. Also included were photographs showing modernization methods, plus a display of breakers, switchgear, busduct and similar components recommended for modernization applications. Also welcoming delegates at the Comstock booth were Charles L. Scharfe, Sr. and Jr., vice presidents; Earle Stewart, Chairman of the Board; George E. Wrange; Donald R. Dieringer and John G. Leicht.

Because of the interdependence of the several professions contributing to the creation of a modern building, Miss Bergson urged that there be closer cooperation among architects and engineers, and lighting, acoustical, ventilation, and interior designers. From the viewpoint of the lighting engineer, she observed, such cooperation will make it possible for new lighting designs to keep step with the continuing advances being made in architectural thinking. More cooperation, she pointed out, would preclude wasted effort.

The concluding Conference session included a technical paper on "Dimmer Controls For Lighting" by W. P. Carpenter, engineer, Superior Electric Co., Bristol, Conn., and the final Regional contest runoff in the IES "My Most Interesting Lighting Job" contest.

Contestants in the runoff, and their prize award placings, were as follows:

Residential Class: Sylvan R. Shemits, New Haven Electric Supply Co., New Haven, Conn., First Prize (uncontested).

Commercial - Industrial Class: Russell Benjamin, United Illuminating Co., Bridgeport, Conn., and Joseph Barney, General Electric Supply Co., Bridgeport, Conn. (joint entry), First Prize; Walter J. Staples, Suburban Electric Co., Malden, Mass., Second Prize; and Judd Kaye, The Holophane Co., Inc., New York City, Third Prize.

First prize winners in each class will compete in the final contest runoff to be held at the annual National Technical conference of the Society at Atlanta, Ga., September 9th-13th.

New NISA Chapter Formed

A regional trade association of electric motor service and sales firms in Maryland, District of Columbia, Virginia, and West Virginia has been organized by members of the National Industrial

Service Association, Inc. Called the "Mid-Atlantic Chapter of NISA", the group was organized on June 24, at the Stafford Hotel in Baltimore in a meeting attended by owners of electrical equipment service shops and officials of the NISA.

The NISA is the international trade association of the industry and has more than 1500 members in five countries.

Lee H. Harris of Harco Equipment Co., Washington, D. C. is president of the Mid-Atlantic Chapter. The other officers are: Joseph U. Kauffman, Jr. of Kauffman Electric Co., Vice-president; Leon E. Hopkins, of Carty Electric & Armature Service, Inc., Washington, secretary-treasurer. Members of the executive board are; J. Roland Stolzenbach of the Roland Electric Co.; William A. Hoke of Keystone Electric Co.; and John R. Lange of the Lange Electric Co., Inc., all of Baltimore.

Also attending the meeting were NISA's national president, Alfred Elson Jr., of New England Machine & Electric Co., Pawtucket, R. I.; Joseph B. Wagner of Wagner Electric Service, Philadelphia, a national director of the association; Joseph Previty of Penn Electric Motor Co., Philadelphia, a past president of NISA; and Joseph M. Harrington, executive vice-president of the National Industrial Service Assn., from St. Louis.

SAMUEL W. HUROWITZ, president of Consolidated Electric Construction Company, Inc., New York City, and H. J. Vorzimer, vice president of Federal Pacific Electric Co., Long Island City, attended the annual convention of the New York State Association of Electrical Contractors and Dealers, Inc. The meetings were held at Saranac Inn, Saranac Inn, N. Y., July 1 to 5.

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N. Y. State Electrical Contractors Meet

"Make Every Week an Electrical Week" was the theme of the 58th annual convention of the New York State Association of Electrical Contractors, and Dealers, Inc., held July 1 to 5 at Saranac Inn, Saranac Inn, N. Y. Approximately 450 members and guests attended.

A. Lincoln Bush, New York, was chairman of the opening session, which was Contractors Day; William A. Lyons, vice president, New York State Electric & Gas Corp., Binghamton, chairman of Utilities Day; and John F. Myers, president, Westinghouse Electric Supply Co., Pittsburgh, chairman of Manufacturers and Wholesalers Day.

Carlton E. Schaad, state superintendent, Bureau of Electricity, New York Board of Fire Underwriters, discussed the important revision and additions in the 1956 edition of the National Electrical Code. Some of the subjects he covered were air conditioning, grounding receptacles, and cellular concrete floor raceways.

New horizons in electrical contracting were outlined by Herman L. Weisman, counsel for the New York Electrical Contractors Association. He said that the fantastic growth in electric power in the past ten years will continue through 1980 and pointed out the many opportunities open to electrical contractors in the residential, industrial and commercial fields.

C. Kesley Meytrott, vice president, Consolidated Edison Company of New York, cited the increased public awareness of the significance of inadequate wiring and the resulting demand for wiring improvement in existing buildings and for higher standards in new construction. According to Mr. Meytrott, 230 apartment buildings in New York City were rewired in 1956, and in the first five months of 1957, 189 apartment buildings were rewired.

E. B. Elledge, manager, Equipment Industry Sales, General Electric Company, Schenectady, spoke on "More Power—Your Challenge." He stated that the electrical industry has been growing from 2 to 3 times as fast as the economy as a whole. The home of the future will require annually 5,000 kwh in ten years, compared to 2500 kwh used annually in the average home today.

George Kossoy, attorney with Goldwater & Flynn, New York, talked about "Protecting Your Future" and urged the members to

reanalyze their estate planning to see that they are adequately protected. He also covered proprietorship and partnership, and incorporation, pointing out some of the security measures necessary to provide for the continuance of a firm and the preservation of assets.

The "Housepower" and "Live Better Electrically" programs were outlined by Frank Kitzmiller, Housepower Program Director, Edison Electric Institute, New York. Research has shown that four out of five homes are in need of more wiring, he said. One of the most important jobs is to encourage homeowners to plan for the future rather than just for their immediate needs.

Drayton Heard, Jr., manager, Power Use Department, Westinghouse Electric Corp., East Pittsburgh, spoke of the Westinghouse long-range industry-wide cooperative program of broad electrical service named "Power-Up," which concentrates on increased industrial and commercial load for electric utilities, bringing increased business for contractors and manufacturers. He noted that the future growth of the power market was estimated at a 300% increase by 1970.

Arthur W. Hooper, executive director, National Association of Electrical Distributors, New York, used "America's Greatest Bargain" as his topic. One of the great contributing forces to the growth and expansion of the electrical industry has been the recognition of responsibility by the various groups comprising the industry. As an industry we are spending about $10,000,000 to motiviate people to get interested in the "housepower" in their homes, so that they will have sufficient service and wiring to "live better electrically." I believe, he said that the same courage and common sense that has built this great electrical industry to its present heights will leave no ceiling on how far the industry can advance and will insure full employment for those dependent on it for their livelihood, as well as insure a profitable return for those investing in it.

At the concluding session of the convention, Herbert F. Janick of Rochester, N. Y. was elected president. Other officers elected were: H. A. Webster, New York City, first vice president J. M. Smith, Cohoes, second vice president and secretary; R. J. Knoblock, Syracuse, treasurer; and R. L. Pattengell, Brooklyn, financial secretary.

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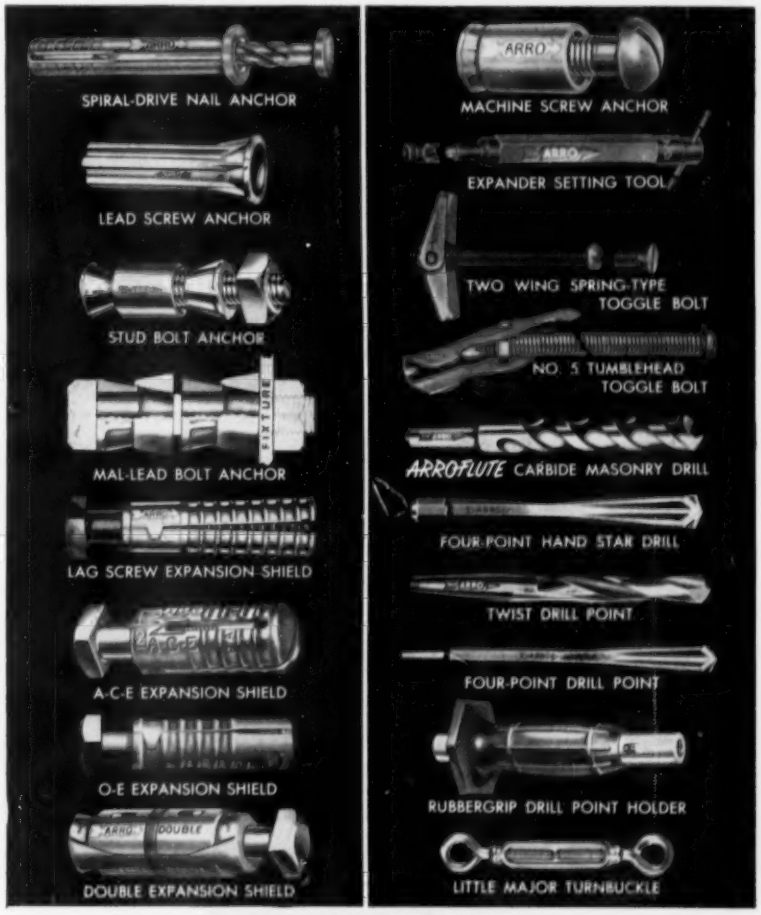

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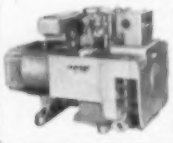

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Plant Maintenance Discussed At West-Coast Convention

Key industrial maintenance men from hundreds of west-coast factories convened at San Francisco's civic auditorium during June to attend a series of conferences and discussion panels which were presented concurrently with the 3rd annual Western Plant Maintenance and Engineering Show. Conference sessions, under the chairmanship of L. C. Morrow, consulting editor of "Factory Management and Maintenance" magazine, probed rising cost problems related to keeping western factories in peak competitive operating condition, while over a hundred exhibitors displayed products and equipment designed to further the effectiveness of this service function.

In opening the first general session, Chairman Morrow stated that the rising spiral of labor, material and distribution costs is forcing industry to increase mechanization and to strive continuously for uninterrupted operation, placing ever greater emphasis upon the capabilities and efficiencies of maintenance personnel.

Manufacturing companies expect to need 15% more scientists and engineers by 1960, he said, and a third of all manufacturing firms in the country are planning to add equipment during 1957 for the sole purpose of bringing out new products. These additions are bound to be reflected in the demand for more maintenance personnel.

In the manufacturing industries, expenditures for capital equipment set an all-time high in 1955, but a 6% increase took place in 1956, another 6% increase is included in plans for this year, while an additional increase of 15% is planned for the next three years. Expansion will take 52% of the capital expenditures of the manufacturing industries in 1957 and 47% between 1958-60, he concluded.

In one of the following discussions, Guy S. Fairhurst, assistant chief engineer for California & Hawaiian Sugar Refining Corp. at Crocket, Cal., stressed the fact that the subject of planning and scheduling maintenance work is a complex one, but, in general, emergency breakdown repair work should receive priority according to need; non-routing work resulting from work requests issued by other departments or engineering shift foremen should be scheduled daily, again determining priorities according to need, while periodic overhaul of major equipment can be scheduled months in advance to fit in with production schedules developed as a result of anticipated sales.

Speaking on the same general subject, Lawrence V. Herich, plant engineer for Cannon Electric Company, Los Angeles, stated that, in his plant, the public address system is used to locate a maintenance man in an emergency, after the foreman has studied the request, checked with the production people if necessary, planned the job, arranged for materials from central stores and has written a requisition. In that way the maintenance man's time is used to greatest advantage.

In an interesting review of maintenance practices at Kaiser Aluminum and Chemical Corporation's aluminum reduction plant at Chalmette, La., Edgar F. Boobyer, chief utilities engineer, first stated that the Chalmette facilities consist of two major plant elements; an electrolytic reduction plant and a thermal power plant of 496,000-kw capability. He added that the maintenance department has direct responsibility of organizing equipment inspection and maintenance schedules throughout the plant, but that frequency and extent of maintenance actions are jointly the responsibility of the operations and technical supervisors, as well, so that availability of equipment can be synchronized with operational safety and production demands.

Backbone of the preventive maintenance program, he added, was periodic inspections, while the effectiveness of the program was illustrated by the fact that total maintenance costs today are approximately the same as they were four years ago, although separate labor and material costs have increased 30% during that period.

Principles of Maintenance Storekeeping was the subject of Leslie Seager, plant engineer for The Eimco Corp., Salt Lake City, Utah, who said that items for normal stock replacement are ordered to be shipped by the cheapest method, whereas breakdown items are rushed via air parcel post, express or air freight. Code numbers for accounting purposes makes identification simple.

Pros and Cons of Area and Centralized Maintenance were discussed more thoroughly by P. J. Gurklis, general supervisor of maintenance shops for the Dow Chemical Company at Freeport,

Texas; A. J. Wilson, Jr., plant engineer for the Ampex Corporation in Redwood City, Cal., and W. E. Fore, plant engineer for North American Aviation at Los Angeles. Collectively, these men stated that few plants have complete area maintenance plants, although many do have complete central maintenance departments and many have combinations of these two alternatives; area maintenance proving most beneficial in large area plants, and centralized maintenance being of optimum value in small plants where work can be planned, coordinated and scheduled with reasonable ease and flexibility, where major maintenance capital equipment can be centralized in a shop with minimum duplication and greater accessibility, where work backlog data and priorities can be maintained by crafts, while standardization of methods, procedures, materials and tools can be directly controlled and carried out on a company-wide basis with liaison of all groups handled in one office.

An Effective Organization of Maintenance Manpower can be created by following a 5-point objective, stated H. J. McKeever, manager of service shops for the General Electric Company in San Francisco. These points are to (1) determine the goals or objectives, and a budget, (2) staff each function with competent manpower, (3) establish clearly lines of responsibility, authority, and accountability, (4) provide the necessary facilities, tools and equipment, and (5) measure performance.

Of particular interest to electrical men present was a discussion on the Maintenance of Electrical Equipment by O. H. Wells, engineering and service supervisor, Westinghouse Electric Corp., San Francisco. In this discussion, Wells covered the main subjects of switchgear, transformers and rotating equipment, with emphasis upon a comparison of various methods of testing. Switchgear was further discussed on the basis of air and oil circuit breaker primary and secondary disconnecting contacts, control devices, busses and connections, ground shield or shutter, secondary wiring, and battery and charger equipment. Transformers were discussed on the basis of insulating media, gasketing, bushings and connections, and various protective devices. Wells stressed the importance of history files and cards on each piece of apparatus, listing conditions found and work done on each inspection.

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Another subject discussed by more than a single speaker concerned "Getting Maintenance People to Work as a Team." This topic was developed by Douglas W. Egelston, supervising maintenance engineer for Marchant Calculators, Inc., Oakland, Cal., and Adrian G. Sira, master mechanic in the U. S. Naval Shipyard at Pearl Harbor. Egelston mentioned that his department has adopted a cross-training system, wherein each man benefits from the knowledge and experience of others. This involves having a personal knowledge of each worker, their basic personalities and interests, as well as their skills and knowledge. This is essential in coordinating a well-balanced team since personality problems are one of the most common obstacles in the path of effective teamwork.

Training of maintenance personnel was further discussed by Melvin Muller, maintenance and repair superintendent for National Biscuit in Portland, Ore., who mentioned that a new trainee should understand the type of work to be undertaken; have a knowledge of job expectancy for immediate and long-range advancement opportunities; know company rules, attitudes and conduct standards; develop cooperative relationships with other employees as well as with supervisors; develop regularity and punctuality in attendance; have consideration for plant safety, union affiliations and good housekeeping practices.

Still another subject of interest to electrical delegates pertained to the establishment of Work Standards. This topic was analysed critically by R. H. Edgecumbe, chief industrial engineer, Virtue Brothers Mfg. Co., Los Angeles, as a team." NISA's future, he notes, "looks very bright."

NISA News

On June 1, Joseph M. Harrington, formerly assistant executive vice-president of NISA, assumed the duties of executive vice-president, replacing Fred B. Wipperman who is staying on as a consultant. "With Joe's training in association work," writes NISA national president Al Elson, "with his youth, drive and personality, he will bring to our association the type of leadership that will enable us to consolidate the gains of the past and forge ahead to a stronger and more active association in the future."

Elson, who is president of the New England Machine & Electric Co. of Pawtucket, Rhode Island, has urged NISA's directors, chapter officers and members to "work

President Elson has appointed committees for the 1957-58 year. Chairmen of the 22 groups include:

Joseph B. Wagner, Wagner Electric Service, Philadelphia, chairman of audit committee;

Frank Ross, Ross Electric Motor Shop, Fairmont, Minn., the national treasurer of NISA, chairman of the budget and finance committee;

John M. Young, Anderson-Young Electric Co., Lubbock, Texas, chairman of by-laws and resolutions committee;

Charles Blenkhorn, Blenkhorn & Sawle, Ltd., St. Catherines, Ont., the national secretary, chairman of the Canadian affairs, rebuilding motor standards and sales survey committees;

J. Arthur Turner Jr., of Tampa (Florida) Armature Works, chairman of the chapter affairs committee;

Thomas M. Paul, of Paul Electric Co., Sioux City, Iowa, chairman of chapter territories and regional boundaries committee;

Paul M. Sievert, the national vice-president of Sievert Electric Co., Chicago, chairman of educational and employee training;

Carl Lundberg, Cascade Machinery Co., Seattle, Wash., chairman of engineer's advisory and used equipment committees;

Joseph F. Dudley, Dudley Electric Works, Flint, Mich., chairman of group insurance committee;

Alex A. Shovan, Industrial Electric Service Co., Hawthorne, N. J., chairman of the Idea Contest;

Frank W. Sloan of San Diego, Calif., chairman of industrial relations;

Ben J. Horton, Atkinson Armature Works, Pittsburg, Kansas, chairman of marketing;

Murphy G. Miller Sr., Tennessee Electric Motor Service, Knoxville, Tenn., chairman of membership committee;

John W. Overton, Electric Motor & Repair Co., Richmond, Va., chairman of publications and publicity committee;

Rex Woodward, Dowzer Electric Machinery Works, Mount Vernon, Ill., chairman of rebuilding standards for transformers;

Charles J. Covington, of the same firm, chairman of trade relations;

Robert B. Turner, of Johnson-Turner Electric Repair and Engineering Co., Windsor, Ont., chairman of management committee;

Joseph H. Previty, Penn Electric Motor Co., Philadelphia, Pa., chairman of public affairs.

Selden F. High, Sullivan Electric Co., Cincinnati, Ohio, chairman of research.

More than 150 NISA members have been appointed to serve on these committees, Elson announced.

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The chapter visitation itinerary of national president Elson includes trips to Beaumont, Texas; Brainerd, Minn.; and Cleveland, Ohio in September, to attend meetings of NISA's Southwestern, North Central and Greater Cleveland chapters. Elson also plans to return to Buffalo, site of the 1957 national convention, to visit the Niagara Chapter in November.

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Members of the New Orleans Chapter met with President Elson, Executive Vice-President Harrington and Horace Barks, editor of NISA News, on July 9 at Irwin's Restaurant. S. J. Stewart, chapter president, has been named general chairman of the convention. Mrs. Margaret Johnson will head the women's program. Other committees will be announced shortly.

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A swing through NISA's eastern chapters has been planned in March by Executive Vice-President Joseph M. Harrington and President Al Elson.

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It's a new and larger building for one of NISA's members in Mexico, Taller Electric Maldonado of Monterrey.

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Rocky Mountain Chapter is issuing a newsletter to its members and prospects. The chapter was organized last February, one of four to be established this year. The others are Heart of America, Connecticut and Mid-Atlantic.

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Bill Chumley, formerly of G. E. Jones Electric Co., Amarillo, has joined American Kloeckner-Moeller Corp., Tulsa, Okla., a NISA associate member.

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Mid-South Chapter met in Mobile, Ala., June 15. The program included presentation of a film on epoxies, shown by George Trieber, sales manager of John C. Dolph Co. Walter Brush and Ed Grant, shop operators, reported on the Buffalo convention. Murphy G. Miller of Knoxville, Tenn., a shop owner and member of the NISA board of directors, also gave a brief report on the association's national affairs.

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Clarence E. Harmon of J&H Electric Co., Providence, R. I., was

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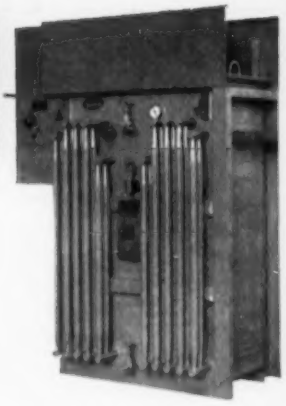

Let Standard Transformer Company engineers help you meet load center problems. We'll work with you to design the transformers required to operate with existing switchgear or with new switchgear. Send us your plans or problems today and let us work out a practical, efficient, and economical solution with you. Write Standard or contact the nearby Standard Transformer Company Representative.

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This is a class in *service*. The "students" are your electrical distributor's salesmen. They give their own time – evenings or Saturday mornings – to learn better ways to serve you.

Service doesn't work an eight-hour day. New recruit or 20-year veteran, your electrical distributor's salesmen stay in training to bring you service that makes your job easier, that saves you time and money.

Frequently, manufacturers of the products you use send product specialists to these meetings. From them, the distributor's salesmen absorb design and application features, product details to help you – the user – get full value from your purchase.

These salesmen soak up facts about the products they supply – ideas and information they can pass along to keep you informed on *all* the advantages the products offer you.

Service is the most important product they supply. That's why it pays to do business with your electrical wholesale distributor.

ELECTRICAL Wholesaling
A McGRAW-HILL PUBLICATION

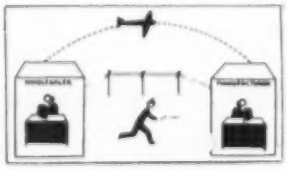
The industry's sales and management magazine

ABP
ABC

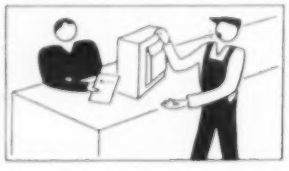
Your electrical distributor offers you these services:

His hundreds of purchase orders keep a flow of thousands of different products rolling from manufacturers into his warehouse the year around.

By airmail, telegraph, telephone, the distributor keeps in touch with the many manufacturers whose lines he stocks, to expedite his shipments to you.

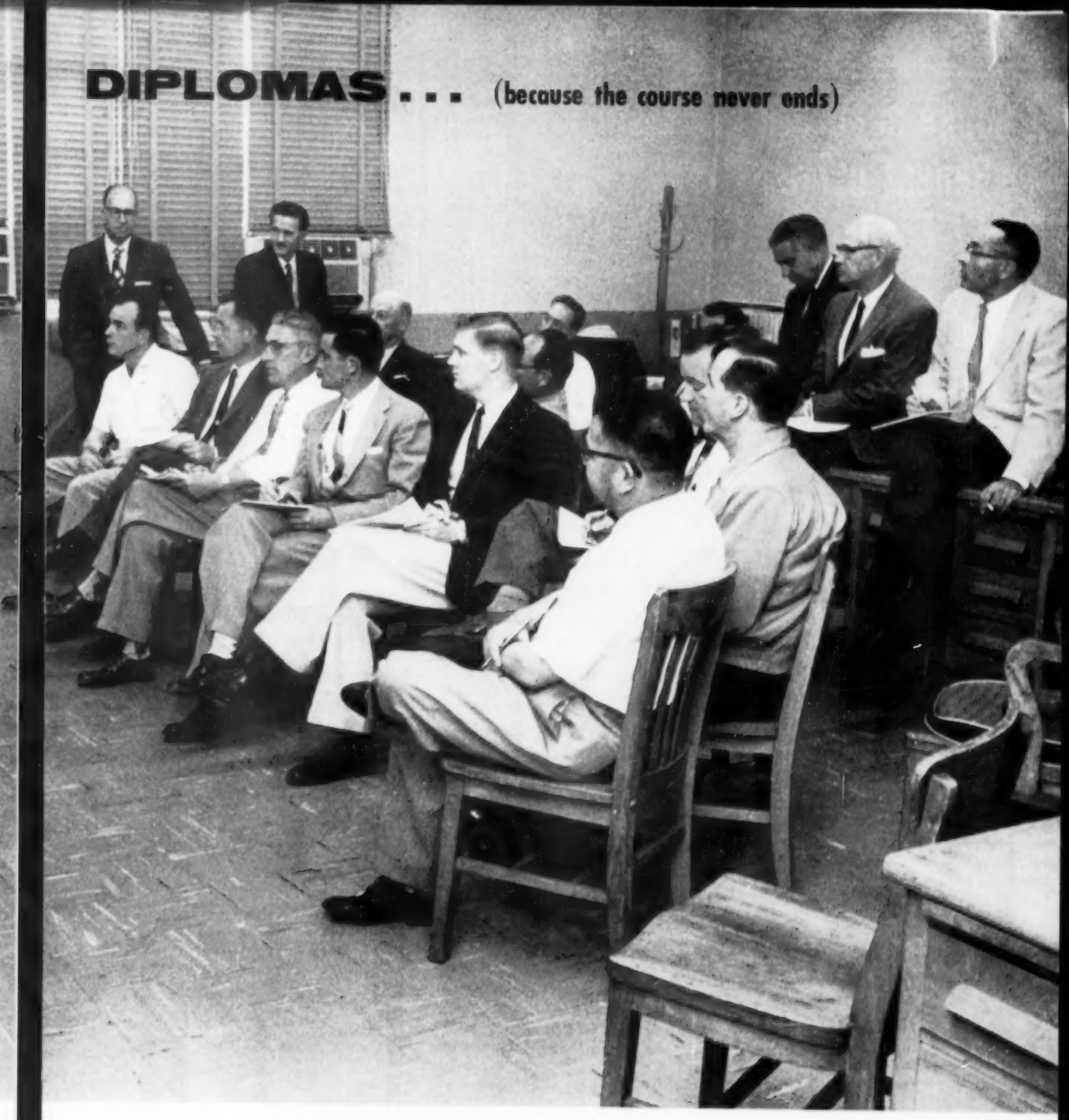


Regardless of how the distant manufacturer ultimately will compensate him, the distributor adjusts claims, returns goods, issues credits.



He trains and maintains a staff of salesmen who know the products required by the industry – where, how and when they are used.

DIPLOMAS . . . (because the course never ends)



He assembles into single shipments the products of factories near and far, in sizes, types, and quantities the user needs.

He maintains a warehouse from which you receive swift, economical delivery of a vast variety of products, plus staggered storing for specific jobs, as needed.

His counter and telephone service require trained men who know the hundreds of products handled, their uses, codes and ruling in effect locally.

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SMOOTH UNIFORM BENDS
Repeat bends, as well as smooth offset and 180° bends, are easy and fast to make. When using a "Chicago" pipe bender you always turn out professional work quickly without any special skill. The accurate bending sector does the work and supports the full length of bend.

RUGGED . . . PORTABLE
An occasional drop of oil on the powerful toggle-ratchet mechanism is the only maintenance required. There are no loose parts to be misplaced or lost. Its light weight, 66 lbs.*, makes it a real on-the-job tool . . . always at a comfortable working height.

*No. 1—66 lbs.
No. 2—89 lbs.

Illustrated . . .
No. 2 for bending
1" to 1½" conduit

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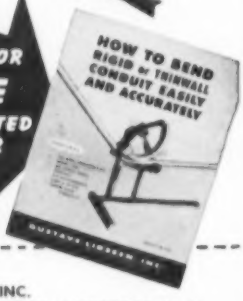

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COMPANY_____

ADDRESS_____

CITY_____

presented with a certificate for 50 years of service to the electrical industry during the New England Chapter meeting recently held in his city. National president Al Elson made the award.

• • • •

More than 130 attended the New England Chapter meeting. It was "Al Elson Day," celebrating the election of the popular NISA president. The meeting opened with shop tours in Pawtucket, R. I., then the group moved to Providence for more tours and dinner at a local restaurant. Visitors included NISA director Alex Shovan of Hawthorne, N. J. and Connecticut Chapter President William Palmer.

• • • •

J. Roland Stolzenbach, the owner of The Roland Electrical Co. of Baltimore, Maryland, has announced the purchase of the General Electrical Equipment Co. of that city. The shop was owned by the late Abraham J. Morris.

• • • •

Damage estimated at $50,000 was caused by a fire at the Arrow Electric Co. shop in Anaheim, Calif., but a new building was erected speedily and was opened about July 15. Ben Cudeck, Jack Harpster and Bud Cope are the owners.

• • • •

Ed Potter, former national director of NISA, is the new president of the Northwest Central Ohio Chapter of NISA. Mr. Potter is general manager of Lima (Ohio) Armature Works. Other officers of the chapter include: Vice-president, Nat Greene of National Electric Coil Co., Columbus, Ohio; treasurer, Fred R. Wilkin of American Electric Works, Inc., Lancaster, Ohio; secretary, Paul A. Wagner of Motorite Electric Co., Dayton.

• • • •

Tyree T. Thomas, treasurer of Electrical Equipment Co., of Raleigh, N. C., Richmond, Va., Augusta, Ga. and Laurinburg, N. C., has been named president. He will continue to be manager of the Richmond branch.

• • • •

Southeastern Chapter will meet at Miami Beach's Fontainbleau Hotel on Oct 24-26 for its annual conference. An all-expense three-day tour of Havana will be given as an attendance prize.

• • • •

Los Angeles Chapter met July 9 in Glendale, Calif., touring the Marcus Electric Motor Repair shop before dinner at The Forge restaurant.

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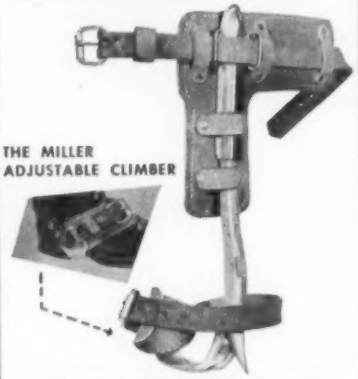
the MILLER Adjustable Climber, with improved removable gaff and adjustable shank, is the most sensational climber in the safety field. For safety, long life and economy specify MILLER. Write to Dept. 257 for full technical information.



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DATES AHEAD

Western Electronic Show and Convention—Cow Palace, San Francisco, Calif., August 20-23.

American Institute of Electrical Engineers—Pacific general meeting, Pasco, Wash., August 28-30; Fall general meeting, Chicago, Ill., October 7-11.

National Association of Electrical Distributors—Western region annual convention, Hotel del Coronado, Calif., September 8-11.

International Association of Electrical Inspectors — Northwest Section, Spokane, Wash., September 9-11; **Western Section,** Sherman Hotel, Chicago, Ill., September 23-25; **Canadian Section,** Park Plaza Hotel, Toronto, Ont., October 4-5; **Eastern Section,** Rochester, N. Y., October 7-9; **Southern Section,** Dinkler-Plaza Hotel, Atlanta, Ga., October 14-16; **Southwestern Section,** Westward Ho Hotel, Phoenix, Ariz., November 4-6.

Illuminating Engineering Society — 51st Annual National Technical Conference, Biltmore Hotel, Atlanta, Ga., Sept. 9-13.

Instrument Society of America—12th annual instrument-automation conference and exhibit, Cleveland Auditorium, Cleveland, Ohio, September 9-13.

Technical Conference on Electrical Maintenance—King Edward Hotel, Toronto, Ont., Canada, September 27-28.

International Association of Electrical Leagues—Annual meeting, Sheraton-Sinton Hotel, Cincinnati, Ohio, October 2-5.

Electrical Progress Show — Commercial Museum, Philadelphia, Pa., October 7-9.

National Electronic Conference—Hotel Sherman, Chicago, Ill., October 7-9.

Canadian Electrical Manufacturers Assn.—13th annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont., Can., October 9-11.

Rocky Mountain Electrical League—Annual convention, Broadmoor Hotel, Colorado Springs, Colo., October 13-17.

Florida Association of Electrical Contractors — Annual Convention and Electrical Trade Show, Soreno Hotel, St. Petersburg, Fla., October 16-19.

National Electrical Manufacturers Assn. — Annual convention, Traymore Hotel, Atlantic City, N. J., November 11-15.

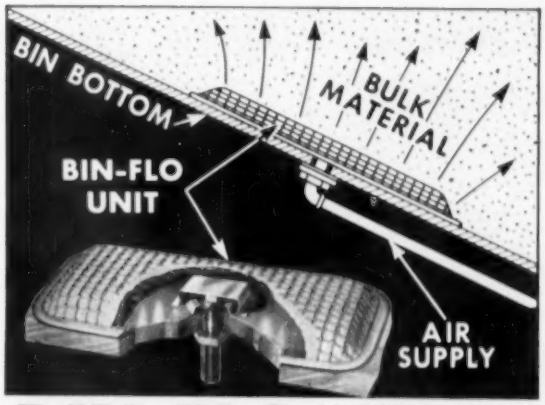
National Electrical Contractors Association—Convention and Exposition Music Hall, Cincinnati, Ohio, November 11-16.

American Standards Assn. — Eighth National Conference on Standards, St. Francis Hotel, San Francisco, Calif., November 13-15.

Air-Conditioning and Refrigeration Industry — 10th Exposition, International Amphitheatre, Chicago, Ill., November 18-21.

American Institute of Electrical Engineers — Winter general meeting, New York, N. Y., January 20-24, 1958.

National Rural Electric Cooperative Assn. — Annual meeting, Dallas, Texas, February 2-6.



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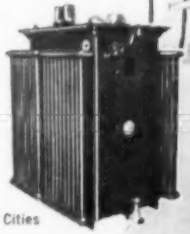

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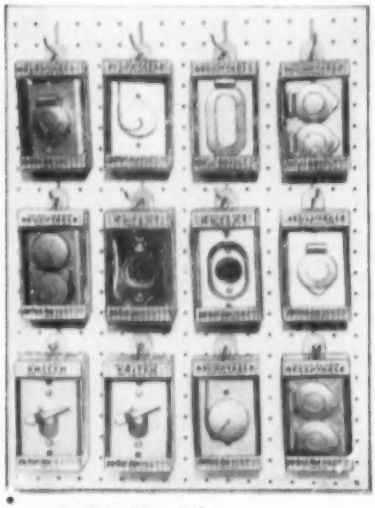

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Among the Manufacturers

Headquarters Announcements

H. F. Porter Co., Inc., New York, N. Y.—E. G. Counselman, manager, industrial sales.

Federal Pacific Electric Co., Newark, N. J.—Robert L. Bobo, sales manager; Leonard Shelley, vice president, in charge of Western Sales Region; Paul M. Hafer, manager, Cleveland plant.

Hill Transformer Co. Inc., San Carlos, Calif.—Walter F. Dimmick, executive vice president.

Induction Motors Corp., Westbury, N. Y.—Joseph James Clark, director.

Fairbanks, Morse & Co., Chicago, Ill.—Robert H. Morse, Jr., president and chief executive officer; Gordon R. Anderson, vice president, engineering; F. M. Mason, Jr., vice president, government business.

Emerson Electric Mfg. Co., St. Louis, Mo.—Albert C. Dickson, assistant to the vice president, engineering and research.

Robertshaw-Fulton Controls Co., New York, N. Y.—Thomas T. Arden, president; John A. Robertshaw, chairman of the board.

McGill Mfg. Co., Inc., Valparaiso, Ind.—Edward P. Grass, general manager, Electrical Division.

Westinghouse Electric Corp., Pittsburgh, Pa.—Robert M. Harris, sales manager, Miniature Lamp Dept. in Bloomfield, N. J.; Gordon W. Howson, sales manager, Large Lamp Dept., Bloomfield; S. F. Johnson, manager of apparatus and defense advertising.

Square D Co., Detroit, Mich.—Paul R. Shawver, manager, Cedar Rapids, Iowa, plant.

Belden Mfg. Co., Chicago, Ill.—Don Walsh, sales service manager, Merchandise Sales Division.

Chase & Sons, Inc., North Quincy, Mass., have acquired controlling interest in Gro-Cord Rubber Co. of Lima, Ohio.

Murray Mfg. Co., Brooklyn, N. Y.—John J. Doyle, vice president in charge of sales.

General Electric Co., Large Lamp Dept., Cleveland, Ohio—James C. Forbes, manager, residential sales.

BullDog Electric Products Co., Detroit, Mich.—Hugh V. Diamond, Jr., sales service manager.

Homes, Schools, Factories

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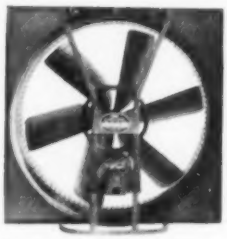
Is The Answer to Low-Cost Cooling



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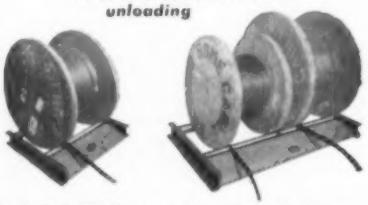

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Gedney Electric Co., New York, N. Y.—Edward T. Corbus, sales manager.

Anaconda Wire & Cable Co., New York, N. Y.—L. F. Hickernell, vice president-engineering; David T. Werner, manager of new plant in Watkinsville, Ga.

General Electric Co., Chemical Materials Dept., Schenectady, N. Y.—T. C. Ohart, general manager, Insulating Materials Section.

Kyova Fiber Pipe Co., Ironton, Ohio—Jack M. Dollenmaier, vice president in charge of marketing and sales.

Benjamin Electric Mfg. Co., Des Plaines, Ill.—Joseph H. Williams, advertising and sales promotion director.

Sunbeam Lighting Co., Los Angeles, Calif.—Henry Gluck, sales manager.

Electric Storage Battery Co., Philadelphia, Pa. — Monroe G. Smith, general manager, Exide Industrial Division.

General Electric Co., Schenectady, N. Y.—Nathan L. Whitecotton, commercial vice president, headquarters in Philadelphia.

Philadelphia Insulated Wire Co., Philadelphia, Pa.—Robert W. Campbell, sales manager.

William Brand & Co., Inc., Willimantic, Conn.—William Brand, chairman of the board; Alfred W. Brand, president; Frank S. Lombardo, vice president, manufacturing; Abraham G. Ginsberg, vice president, Fall River plant; Henry K. Lathrop, treasurer; Theodore M. Sanden, vice president, sales.

Regional Appointments

NEW ENGLAND

Tomic Sales and Engineering Co.: Arnold L. Mackowsky, sales representative for the New England states.

MIDDLE ATLANTIC

Penn Instruments Div., Burgess-Manning Co.: Scott Saunders, sales engineer in charge of New York area; William Applegate, sales engineer in charge of Philadelphia and New Jersey areas.

Ruby-Philite Corp.: Fred C. Olsen, sales representative in New York state.

Westinghouse Electric Corp., Lamp Division: John H. Max, Atlantic region sales manager.

Walker Brothers: Herbert C. Zang, representative in New York and Pennsylvania.

Anaconda Wire & Cable Co.: Henry Johnson, district manager, Newark, N. J. office.

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SOUTH ATLANTIC

Moe Light Division, Thomas Industries Inc.: Charles Cockrill, sales manager, Southeastern Div.

Anaconda Wire & Cable Co.: Richard Kellogg, Washington, D. C. district manager; Jackson B. West, district manager, Charlotte, N. C.

EAST CENTRAL

Penn Instruments Div., Burgess-Manning Co.: James H. Floeck, sales engineer in charge of Chicago area.

Electro Silv-A-King Corp.: L. O. "Sheriff" Ledford, district manager in Middle and East Tennessee and parts of Georgia and Virginia.

Mark Simpson Mfg. Co., Inc.: Harry Halinton & Son, Chicago, representative for sound equipment line.

Ramset Fastening System: Henry G. Walesch, district sales manager covering Northern Ohio, Pittsburgh, and Northwest New York state.

Okonite Co.: J. C. Wickes, regional sales manager of Philadelphia, Boston, Cincinnati, Syracuse, Detroit, Cleveland and Pittsburgh officers.

Diehl Mfg. Co.: James E. Haney, Mid-West factory representative.

M. H. Rhodes, Inc.: John S. Ridinger, sales representative for Western Pennsylvania.

Anaconda Wire & Cable Co.: Robert Sullivan, Cleveland district manager.

WEST CENTRAL

Okonite Co.: Dewey A. White, regional sales manager of Birmingham, New Orleans and Dallas districts.

Moe Light Div., Thomas Industries, Inc.: John Norbert, sales manager, Mid-Western Division, office in Kansas City.

General Electric Co., Large Lamp Dept.: Robert L. Oetting, manager, Southwestern Sales District, office in Dallas.

Boston Woven Hose & Rubber Co.: Morton & Cook Co., sales representative for North Dakota, South Dakota, Minnesota, and Northern Wisconsin.

WEST

Carrier Corp.: John F. Kooistra, Western Regional manager for Machinery and Systems Division.

Prescolite Mfg. Corp.: William A. Llewellyn, sales representative in Southern California area.

Anaconda Wire & Cable Co.: William Gaylord, district manager, San Francisco.

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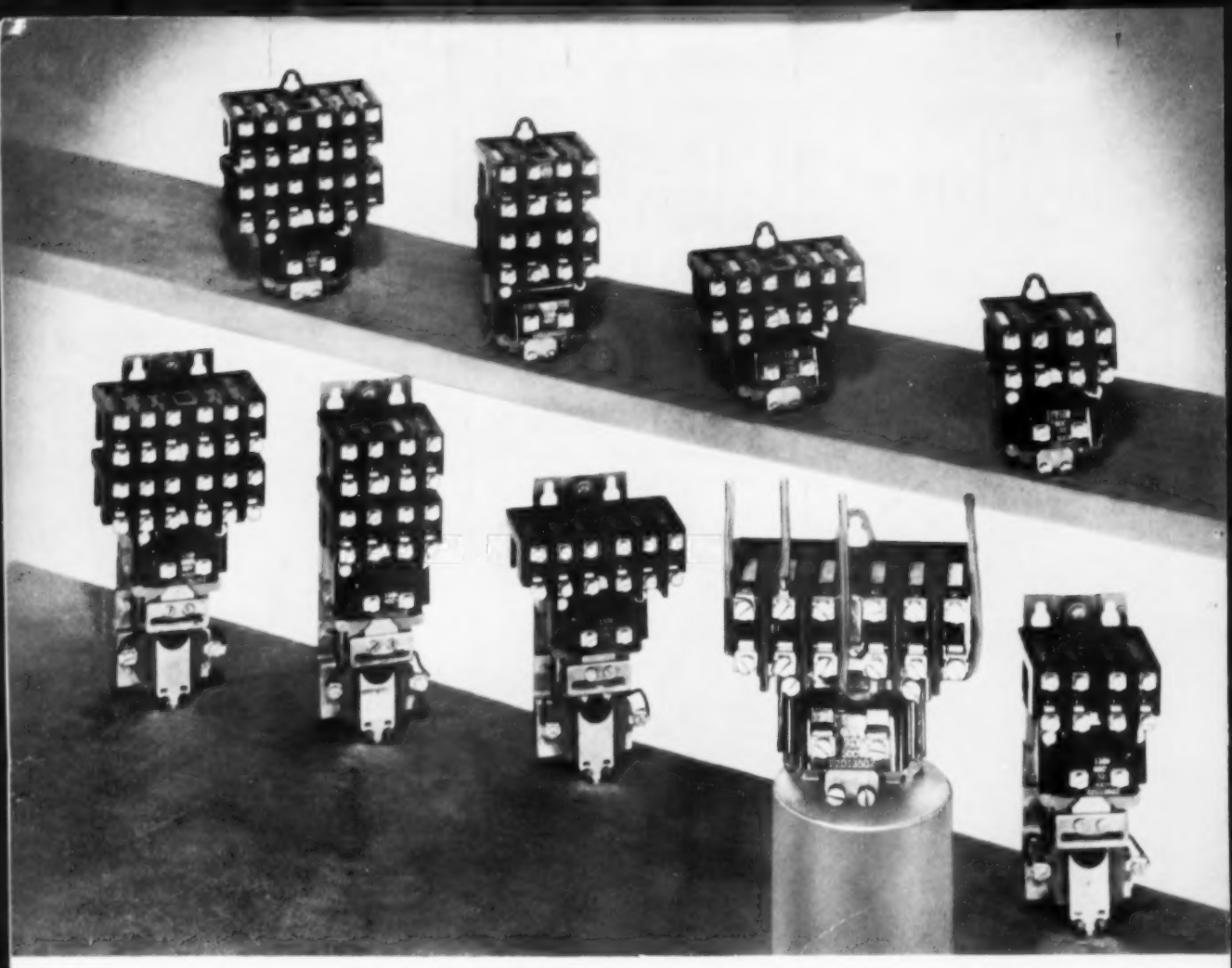

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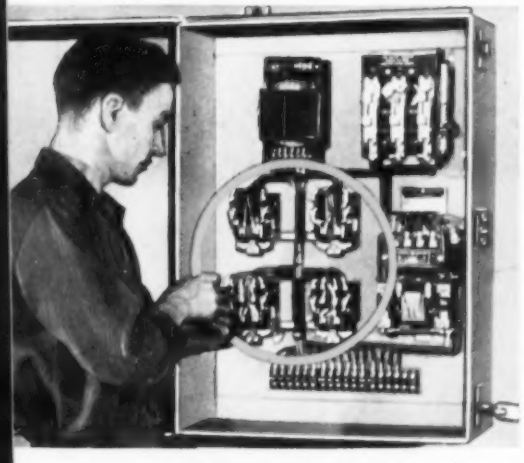

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